SCIENCE.

FRIDAY, MAY 2, 1884.

COMMENT AND CRITICISM.

ALL friends of science and learning must earnestly hope that the difficulties between the board of managers of the Winchester observatory of Yale college, and the observatory committee of the corporation, will be settled without injury to the institution. The organization of the observatory seems to be somewhat complex. The corporation of the college, in whose hands the supreme power is placed, finding itself unable to immediately organize the establishment, appointed a board of managers, among whom were included Professors Lyman, Newton, and Loomis, to advise and recommend measures, and to execute such plans as should be approved by the corporation. Under this authority, Professor Newton was made director before the funds were sufficient to justify the completion of the organization. The horological and thermometric bureaus were established before any appliances for astronomical work were completed. In the mean time, a heliometer of the first class, indeed the largest and finest ever made, has been procured, and arrangements made for its use by a skilful astronomer.

The present difficulty seems to have grown out of the peculiar position of the two bureaus above mentioned, which gave rise to a divergence of views on the subject of their relations to the rest of the establishment. These bureaus have done excellent work in testing thermometers and time-pieces, and in calling public attention to the lack of precision in observations of temperature, owing to defects in thermometers. Notwithstanding their public utility, the board of managers seem to have considered the propriety of their permanent support from a fund designed for scientific research as open to question, while the corportation committee desires to make them the main feature of the institution, and, indeed, to take them out of the control of the director. This committee also proposes to abolish the board of managers, which seems to imply dissatisfaction with their work, and to organize the observatory in a way which is so strongly disapproved by the board, that Professor Newton has resigned the directorship, and at least one other member has left the board. As the details of the plan have not been made public, it cannot be made the subject of intelligent criticism; but it is hardly possible to avoid the impression that the authorities of the college are not sufficiently alive to the necessity of having the observatory managed by some competent and responsible authority, whether an individual or a board.

THE recent award of the gold medal of the Royal astronomical society to Mr. A. Ainslie Common of Ealing, Eng., reference to which is made in another column, should prove a powerful incentive to the amateur astronomer; and the remarks of the president of the society, Mr. E. J. Stone, in his presentation address, are no less important as indicating in general the way in which the amateur should go to work. A clear conception of the needs of astronomy in some special direction should precede all efforts to provide instrumental means; and the means should thus be suited to the ends sought. The speedy fossilizing of many an excellent instrumental outfit might thus be forestalled. The professional astronomer is frequently compelled to note the absolute incomparability of work done with the costliness and variety of the instrumental outfit; which means, of course, that scientific work of real worth is achieved, not so much by the telescope as by the observer who stands behind it. And it is worth the while, in this era of big telescopes, when the chief inquiry relates to the superior limit in size attainable, to glance backward at the results already

secured with telescopes approaching the inferior limit in aperture, and take note of the amount of work, of much the same sort, remaining to be done, largely, to be sure, of a character not intended to elicit profuse applause.

AMERICANS are less sensitive than formerly to foreign criticism, but a recent series of incidents would indicate that foreigners are beginning to be sensitive in respect to American criticism. Some six months ago a writer in *Science* called attention to the three principal currents of scientific work, — German, English, and French. He was critical in his comments, but his criticism was evenly distributed; and American work did not escape his eye. On the whole, Germany was most praised, and France least praised. The article was copied into *Nature*, and was translated for the *Revue scientifique*. The editor of the *Revue*, Mr. Charles Richet, came to the defence of France against the writer in *Science*. Now comes the work of Father Didon, on German education (*Les allemands*, Paris, 1884), which reprints a translation of the original article in *Science*, and Richet's rejoinder. The charge and the countercharge are thus brought into juxtaposition in a book which is likely to be widely read.

We are interested in Richet's answer. To the charge in *Science* that the French neglect foreign science, especially German, a flat denial is given; and a list of books translated from German into French within a short time past is printed. To the charge that the French are producing nothing new, reference is made to the current pages of the *Comptes rendus*. To the charge that "science has never been so depressed in France as at present," the chief attention is given. Mr. Richet points triumphantly to three names, — Pasteur, J.B. Dumas, and *de Lesseps*, and then, after asserting the distinction of these three leaders, the writer proceeds to look calmly at the situation. It is instructive to observe what he admits. In science, he says, France is like an army which has leaders, without soldiers enough. No French *savant* has around him a numerous group of students; and consequently the selection of professors for chairs of science is constantly becoming more difficult. It is not so, he admits, in Germany. Why is it thus in France? Because superior instruction is so poorly paid. Millions are needed to place the country in the right condition. Professorships and laboratories should be established; but, more than that, ideas must be changed, and larger numbers of young men must devote themselves to researches which have no obvious practical bearing, — *recherches scientifiques désintéressés*.

Much of Richet's comment on France would apply to this country. The United States, like France, stands in need of more professorships, and more laboratories, devoted to the promotion of science. We need, also, more young men willing to renounce careers which will yield pecuniary returns, and ready to labor for the promotion of knowledge, and the enlargement of the boundaries of human thought. But no one should consecrate himself to such a life, unless he has the assurance of support, or unless he is willing to face the restrictions of a poorly paid career.

THE tests of a theory are found not only in its accordance with facts known at the time of its proposal, but still more in its accordance with conditions discovered afterwards. The admirable studies of tornadoes now in progress, as described in our notes, are fertile in discoveries of the special conditions in which these destructive storms arise; and, as far as published, all of these newly found limitations of occurrence give the most direct support to the mechanical theory of tornadoes put forth by Mr. Ferrel a few years ago. The tornado district, as now determined, is one where warm air is overflowed by cold air: here is found the cause of the marked vertical differences of temperatures which the theory had accepted from less extended observations. The district is distinctly within a cyclonic, spiral circulation

of the atmosphere, and is found to have a very definite position relative to the centre of the cyclone; and this directly confirms the explanation given by Mr. Ferrel of the persistent left-handed rotation of the tornado, as well as of its regular direction of advance. There is no better example than this, of the successful deductive study of meteorology.

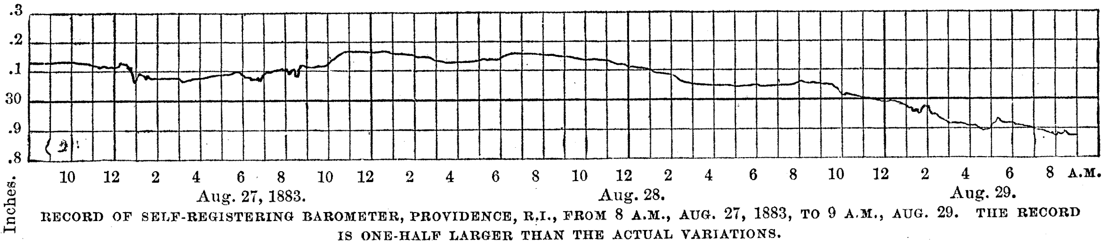
There are, of course, other theories of tornado action still held. The electrical, or, as it may be called, the vague theory is one of the most popular; but fortunately it is condemned by electricians. The theory of descending winds, or of commotions beginning in the upper air, and then descending to the ground with actual downward currents, has had not a few supporters, but now seems to be defended only by Mr. Faye of the French bureau of longitudes. The last *Annuaire* of this bureau contains a brief repetition of his *Défense de la loi des tempêtes* of 1875, in which he persists in regarding tornadoes and storms in general as down-cast draughts of air, and, strangely enough, finds proof of his statements in the descriptions of western tornadoes published by the signal-service, which make mention of the 'descent of the tornado cloud.' It is quite time that the downward 'growth' of the cloud should no longer be misapprehended, and that the real meaning of this significant appearance, so long ago well explained, should be generally understood. But, before an error finally disappears, it is natural enough to find it restricted, like an organic species on the verge of extinction, to a small habitat, like the Island of Mauritius, or the Bureau of longitudes, where it makes a determined resistance. There it survives for a time as a curiosity, a relic of by-gone days.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Atmospheric waves from Krakatoa.

I NOTICE, in your publication of the 14th of March, an account of an atmospheric wave which took place soon after the eruption of Mount Krakatoa. Thinking that it may be of interest, I enclose a copy of a sheet taken from a self-registering barometer that is under my charge. The fluctuations shown by the barometric line upon this sheet are very unusual; but,



RECORD OF SELF-REGISTERING BAROMETER, PROVIDENCE, R.I., FROM 8 A.M., AUG. 27, 1883, TO 9 A.M., AUG. 29. THE RECORD IS ONE-HALF LARGER THAN THE ACTUAL VARIATIONS.

as I was in Europe at the time they occurred, I can only say that the sheet must explain itself, and that the barometer is a very sensitive and reliable one.

EDMUND B. WESTON.

Providence, R.I., April 16.

Your correspondent, '$\mathfrak{S}$.,' in *Science*, No. 63, would seem to be wrong in attributing to the atmospheric waves following the Krakatoa explosion any thing like the character of the rapid waves of compression and expansion which cause sound; for this would be the kind of disturbance referred to as following the explosions of powder-mines, which disturbance generally takes the form of shattering glass windows, and is probably due to the suddenness and unusual amplitude of the first wave of compression, or perhaps to the shivering vibrations set up in the window-sashes, or in the whole sides of wooden buildings. None of these waves could, on account of their frequency, show themselves at all on barometric traces.

In the Krakatoa waves the barograph traces, combined with the velocity of transmission, show that these waves must have been long, smooth swells (varying from fifty to five hundred or six hundred miles in length, with the shorter waves sometimes superposed upon the long ones) something like the ground-swell of the ocean, only with the waves much longer than the latter, and travelling in an elastic medium whose density and pressure vary from that at the earth's surface up to zero.

For the cause of such an unusual condition of the atmosphere, we must examine the results of the new hydrographic survey of the vicinity of Krakatoa, as published in *Nature*, 1884, Jan. 17, p. 268 (also, in part, in *Science*, No. 54, p. 211), and also the data

from the logs of some of the vessels caught in the Straits of Sunda at the time (see *Nature*, 1884, Jan. 10, p. 240).

A careful consideration of the data there available would seem to render it almost certain, that, in this Krakatoa explosion, something like two or three cubic miles, perhaps more, of earth which formed the northern part of the volcanic island and its underlying strata, were blown into the air to some unknown height, and clearing entirely Lang Island, lying immediately north-east, came down again six or eight miles to the northward and eastward. As this probably took place at a single explosion, and as large amounts of gases under enormous pressure were almost certainly suddenly set free, to say nothing of the sudden generation of steam, it is, perhaps, not to be wondered at, that this immediate demand for 'more room' should have started a series of waves in the atmosphere (like those in a mill-pond from the plunge of a stone) which travelled several times round the globe.

The vessels' logs above referred to — one reporting the barometer fluctuating between twenty-eight and thirty inches and violently agitated, and another the same rising and falling from half an inch to an inch in half an hour — show how violent was the local disturbance, which, by the time it reached this country, amounted to only about two millimetres.

Doubtless some slight effect of this kind must follow every large explosion, like that of a powder-mill, over some limited area; and it is worthy of note, that Mr. Scott, the secretary of the London meteorological council, in his paper communicated to the Royal society on Dec. 4, 1883, states that the traces of these Krakatoa waves "exhibit considerable similarity to that of the King's barograph at the Liverpool observatory, at the Waterloo docks pierhead, on the 15th of January, 1864, when the Lottie Sleigh, loaded with about twelve tons of gunpowder, blew up. The ship was lying about three miles from the observatory." But this phase of such explosions is entirely distinct from their sound and their window-shattering character.

H. M. PAUL.

Washington, April 21.

Osteology of the large-mouthed black bass (Micropterus salmoides).

Very recently my studies have required me to make several dissections of the large-mouthed black bass, and carefully prepare two or three skeletons of this fish. These skeletons are now before me, and in two of them I notice a very interesting anatomical point. During the course of my reading upon the skeletons of fishes, I have failed to discover any account of a similar condition in any of the Teleostei, and note it here, trusting that I may learn from others, interested in the anatomy of this class of vertebrates, whether or no they have ever observed the same. This consists in a pair of freely articulated ribs at the base of the occiput. Their heads are received in a shallow facet on either side, situated just above and rather internal to the foramen for the vagus nerve. Immediately below each rib occurs the projection of bone that bears upon its entire posterior aspect one of the pair of articular condyles for the first free vertebra of the spinal column. Still beneath these condyles is seen the conically concave facet for articulation, with a similarly formed surface occurring on the centrum of the vertebra just mentioned, and the one which I believe would be described as the atlas.

This pair of ribs is directly in sequence with the abdominal ribs on either side. Their occurrence in this situation might be accounted for by saying that several of the anterior vertebrae of the column had been absorbed by the occipital elements. Mr. Bridge found such a condition in Amia, though no free ribs were present (*Journ. anat. phys.*, xi. 611, Lond., 1877). In the cranium of Micropterus, however, I should think that this would be highly improbable. Both the first and second vertebra of the spinal column of this bass support each a pair of free ribs, and a mid-series of the other abdominal ribs bears epipleural appendages. Dr. Günther states in his account of the osteology of the Teleostei, in article 'Ichthyology,' of the Encyclopaedia Britannica (vol. xii., 9th ed.), that "the centrum of the first vertebra or atlas is very short, with the apophyses scarcely indicated. Neither the first nor the second vertebra has ribs." I have a yellow perch (Perca americana) in my possession where both of these vertebrae support a pair of free ribs.

Should an examination of the young of the black bass show that none of the anterior vertebrae of the column were included with the occipital segments, but that these ribs are truly occipital ribs, then they become of interest from several points of view.

R. W. SHUFELDT.

Washington, March 31.

Caulinites and Zamiostrobus.

As *Science* has devoted a page of its valuable space to Mr. Joseph F. James's copies of Mr. Lesquereux's figures of these plants and his remarks thereon, in which, without having seen the specimens, he essays to overthrow the determinations of the venerable paleontologist, a word in reply may be justified as tending to correct the impression, already quite prevalent, that the determinations of vegetable paleontologists are in large measure mere guess-work.

As regards Caulinites fecundus, little need be said, since its problematical character was sufficiently insisted upon by Mr. Lesquereux in his description. The 'capsules' are much smaller than those of Onoclea sensibilis, and are found in intimate relation with the stems which have been called Caulinites. The matrix is a light, fine-grained shale, showing the longitudinal, parallel nervation of these stems very clearly. It also contains fragments of dicotyledonous leaves which may have belonged to the plant that bore the fruit; but no ferns are present, as these would be clearly shown by their characteristic nervation. It is safe to say, that, if Mr. James had examined the fossils, he would not have said that there was "no doubt" in his "mind that Caulinites fecundus is nothing but a part of the fertile frond of Onoclea sensibilis."

As regards Zamiostrobus, however, there is 'no doubt' that Mr. James is egregiously in error. His confident statements well illustrate the folly of discussing mere figures of objects that are in existence. He has entirely misapprehended the nature of the specimen; and this is not altogether the fault of Mr. Lesquereux's figure. The fossil is a segment of a zone, cut out of a cylindrical or conical body which must have measured about eight inches in diameter. This segment was placed with the exterior surface upward in the drawing, in order to show somewhat in perspective both this surface and the radiate structure of the cross-section from the direction of the centre. The figure is defective in not showing the manifest angle which all the dark spots have on one side, and which fixes their true character as scars of former leaves. It is probably not a cone, as Mr. Lesquereux supposed, but a fragment of one of those

dwarfed cycadean stems or trunks which formerly went by the name of Cycadoidea, but which the Marquis Saporta (Paléontologie française, Végétaux, II.) now divides up into the two new genera, Bolbopodium and Clathropodium. From an examination of his figures, I am inclined to refer it to the latter of these genera. Although found at Golden, Col., which is cretaceous or Laramie, still it is not impossible that this specimen may have been in some way brought to this spot from a locality higher up the adjacent slope, having a position stratigraphically lower. LESTER F. WARD.

The Greely search.

Safely assuming that *Science* admits within its domain facts only, and willingly dismisses errors of observation, I respectfully offer the following corrections of some inadvertences found in your notice, March 28, of the action of the Navy department, and its board of relief for Lieut. Greely.

It is an error to suppose that the report was founded, 'in great part, on the counsels of Capt. Nares and his associates;' for the joint letter of Nares, Markham, and Fielden, dated, as the report shows, London, Feb. 1, could not have been in the board's hands until nearly a month after their submitting that paper, the publication of which was delayed for these and other valued counsels.

The necessity of leaving the ice-navigation 'absolutely' to the judgment of the ice-navigators, that is, to ice-pilots, is also in this case a fallacy. Neither the whalers nor the sealers go north of 70° north latitude, and can have no knowledge of the ice movements in Kane basin, for action in which, the commanding officers are likely to gain as much knowledge as ice-navigators, so far as this *can* be gained in lower latitudes. Once in the basin, the whole problem depends on the judgment and skill of the officer, who must, by careful observation of the local tides and weather, determine when and where to advance. The writer of your notice has ignored the plain fact that the commander, as the only responsible person, must also be the absolute judge of the ship's movements among the most fickle of all known conditions, — the ice-changes. He must, almost without ceasing, be on the watch and in the crow's-nest. In that 'sort of tub,' Hartstene, when out in the search for Kane, "stayed for thirty-six hours on the stretch, with but a bowl of soup sent up to keep body and soul together;" and, according to Markham, Nares almost lived there, from the nest closely scrutinizing the ice motions, the tides, the currents, and the influence of the wind on the pack. "It was entirely due to this that the expedition advanced, although inch by inch." That an ice-navigator of the ordinary type should be equal to this watchfulness, is scarcely among the possibilities; and in this connection the experience of the Proteus is most unfortunately cited by your correspondent, if the captain of that vessel was correctly reported as being confessedly very rarely in the nest. Nor, in another point, is the case a parallel one, inasmuch as the needed naval qualifications could not be expected to be found in an army officer, however marked were his courage and admitted sagacity.

The statements in regard to the failure in providing for scientific observations, and as to the programme of the cruise, are equally at fault. The final decision of the programme for the expedition could not have been made at the date of the writing, and, indeed, has not yet been made known. From the nature of the case, much must be left to the discretion of the officer commanding: he must, as in the case of previous expeditions, sail 'untrammelled.' So far as opportunity shall offer for scientific observations, these will be made by the use of two complete scientific outfits, including photographic apparatus, carefully prepared for meteorological and magnetic work, if the ships should winter north. For this, as well as for previous expeditions, special instructions have been laid down by the department for such observations as will not interfere with the main object. The ships will take out three young officers of the number, which, under the sanction of Secretary Chandler, have been recently on duty at the Smithsonian, under training for just such work. They will be thus prepared to carry out the instructions of Professor Baird, so far as the ever-changing circumstances of the cruise shall permit.

May not the very grave responsibilities of this errand of mercy be intrusted to the department and its selected officers, conscious, as they assuredly are, of these responsibilities, and hoping for that success for which the hearts of the nation wait, as attested by the unlimited appropriation placed at the discretion of the president? When De Haven went out in the search for Sir John Franklin, Admiral Osborn openly said, "I was charmed to hear that officers and men signed a bond not to claim any part of the reward of £20,000 offered by the English government."

Unaware of the existence of any lower tone of character in those who now leave their homes on an errand of humanity, yet of grave uncertainty of success and of personal danger, I submit the preceding corrections, which might, indeed, be extended. They will commend themselves as due to the Navy department, to the officers, and to the mixed board from the army and navy, whose report itself evinces much previous arctic study, and close attention to the wants of the expedition. J. E. NOURSE.

[The question as to whether an officer entirely without experience, and therefore necessarily without skill in meeting certain exceptional conditions, is as well qualified to do so as one who has gained skill by long experience, is one, which, divested of sentiment and class feeling can have but one answer. We are not aware that floating ice north of latitude 70° possesses any occult qualities which it loses on drifting south of that imaginary boundary. The skill and watchfulness of the ice-navigators of the sealing and whaling fleet is a fact which does not depend upon any one's opinion, but has been proved by long years of successful adventure. That the owners of this fleet should require some guaranty in case of success, for putting their property in jeopardy, for what many regard as a forlorn hope, is merely reasonable; and no just parallel can be drawn between them and officers of the navy, who have no pecuniary stake in the vessels to which they are temporarily assigned. The statement in regard to scientific work, 'not inevitable to the expedition' (like meteorological observations), was made on the best authority; and we shall be pleased to learn that the first intention of the commander of the expedition has been modified in the manner the writer inti[illegible]es. That the counsels of Sir George Nares and [illegible]s had great weight in determining the repor[illegible] board, we judged from internal evidence, f[illegible]ct that the report was delayed until those [illegible]ere made known, and because it would have [illegible] most reprehensible if they had not received respectful attention.]

STYLE IN SCIENTIFIC WRITING.

THE conductors of this journal have had for more than a year an opportunity to judge of the literary aptitudes of the scientific writers of this country. The pecuniary resources of *Science* have been sufficient to enable the editor to pay suitably for accepted contributions: his correspondents have been sought in all the places of intellectual activity in this country. Young writers and old, men of fame and the obscure, have all been welcomed as helpers, provided they had any thing worth saying. It is not for us to pronounce upon the results which have been attained, but it may be worth while for us to point out how our friends and helpers can make this journal still more acceptable to those who read it.

We begin with a general principle. One of the results of scientific study is to make men accurate, to encourage exactness in thought and expression. The first quality, therefore, to be desired in scientific writing, is trustworthiness; and, without it, all other merits are of no account. On this point we have no suggestions to make; for our writers, as a class, are men whose statements of fact may be taken with the greatest confidence.

But in addition to accuracy, scientific writing should be in good form. Indeed, proper attention to literary requirements will promote rather than embarrass the desired precision. One of the clearest and most acceptable writers on scientific subjects told us, in reply to the inquiry how it was that he made himself so easily understood on difficult points, that it was because, before addressing a mixed assembly on any abstruse or complex theme, he took great pains to find in advance just the words and the phrases which conveyed his meaning. Certainly one reason why the writings of Darwin, Spencer, Huxley, Tyndall, and Lubbock, — to specify only foreign writers, — have been so widely read, is that their language is so good. It is easy to understand their meaning, for they comply with the well-known law of a well-known authority on style; the desideratum, he tells us, is "so to present ideas that they may be apprehended with the least possible mental effort." We are inclined to add to this dictum of Herbert Spencer the declaration that a good style will exact that amount of attention which animates without fatiguing the rea[illegible]er. Verbosity, awkwardness, undue con[illegible]ness, forgetfulness of the reader's attitud[illegible]ors into which it is easy to fall: clearn[illegible]ess, grace, are merits which it is hard [illegible]e. That which stimulates further though[illegible], and invites to continued reading, is the kind of article most to be desired.

Those writers will do best who keep constantly in mind the audience they are called upon to address. *Science* is not a journal for any class of specialists. It is not published for the sole benefit of the entomologist, or the electrician, or the geometer, or the morphologist, but for the perusal of all such persons, and also of teachers, librarians, engineers, physicians, editors, lawyers, clergymen, and other intelligent and educated men and women who wish to keep informed upon the progress of scientific discovery in all its general aspects, and who wish to be directed to more detailed statements if they have occasion to seek for special information. These pages should present articles so trustworthy, and at the same time so readable, and from writers of such acknowledged ability, that every educated person will be obliged to keep his eye upon all that we print, particularly if he is engaged in any pursuit connected with science.

This is the aim of the conductors of this journal. But such a purpose can never be fulfilled without the hearty co-operation of all the leading scientific men of the country. No editorial staff, however large and complete, can possibly prepare the requisite articles. All that we can do is to call forth, arrange, adjust, amend, and edit that which is produced in the various laboratories, studies, museums, colleges, and technical schools of the country.

Our contributors must, however, remember that the editorial judgment calls for articles by leaders in one department which will be satisfactory to men of intelligence in other departments. As a general rule, the chemist must write so that the biologist may understand him; the mathematician must keep his language of symbols for his own pages, and present us only the conclusions which are of general interest.

But there are limitations to this general principle. There are some announcements so important, or so new, that we shall gladly open our columns to them, in whatever form they are made. Contributions which bring out for the first time important discoveries and researches will always be welcomed, even though they are technical. Words are constantly migrating from the domain of the specialist into that of the general reader. The progress of information rapidly tends to familiarize the public with the scientific vocabulary. It is not against the use of fit words that this article is directed, but against the abstruse, complex, scholastic diction, which any writer may turn, if he will, into clear and accurate English.

ICEBERGS AND ICE-FLOES.

IN the Atlantic, the great oceanic base for by far the larger number of arctic expeditions, icebergs sometimes reach as low as the latitude of Boston. They are to be dreaded mostly in the night, and sometimes in very heavy or foggy weather. This danger, therefore, steadily decreases as the ship nears the pole; and, when she passes the arctic circle far enough to encounter perpetual daylight, it ceases. It is in the lower latitudes, and especially during dark, foggy nights, so common to those regions, that the sharpest lookout must be kept; and here, also, the berg, meeting warmer waters and climate, is, in its disintegration, widely surrounded by a vast *débris* of smaller masses, most of which are equally as dangerous as the parent.

There is one peculiarity of icebergs that is fortunate for those cruising in their vicinity; and that is, their visibility at long distances during dark nights and heavy weather. I remember on the 10th of July, 1878, while making for the eastern entrance of Hudson's Strait, and while off the Labrador coast, our second mate, a keen-eyed Scotchman, caught the faintest glimmer ahead, during a misty morning, about two o'clock, when daylight was just commencing to break. He pronounced it an iceberg, and estimated it to be two or three miles away; and, wearing ship and laying to, we found in the morning that he was not any too far out of the way. This colossus of ice was flanked on either side by its *débris* for three or four miles, some of the pieces standing fully as high as the foremast of our little schooner. With my unseamanlike eyes, even with the aid of a powerful marine glass, I could only make out the slightest break in the inky clouds hugging the horizon; and the mate told me that the navies of the world, a score abreast, could have passed between us and the berg and been invisible. It is a peculiar sheen of their half-polished faces, characteristic of glacier ice, that penetrates so far, and under circumstances where a bank of snow or a ship's sails would not be seen.

So much has been said for and against the thermometric detection of the presence of ice and icebergs, that I dislike to open the subject. Generally, if a ship is approaching ice or icebergs, repeated observations made by plunging a thermometer into the water alongside, or a bucketful from the sea, soon shows the fact by decreasing temperature. These observations are more valuable in the summer than in the winter months, and also the farther south the ice may be encountered, owing to the more rapid change in the observed temperatures under these circumstances; but as nearly all arctic navigation is performed in the brief summer of these regions, and as it is only in the lower latitudes that the nights at this time are sufficiently long to cause apprehension, these observations here become of more value than in true arctic navigation. In the winter season, if the temperature of the water falls as low as 34° F. from a previous higher standard, it may reasonably be inferred that ice is not much farther away than half a mile: 42° F. shows about the same distance in the summer, the thermometer falling rapidly as the vessel approaches. However, the thermometer shows a higher temperature in deep than in the shallow water on banks, shoals, and near the coast-line, often falling from 2° to 6° F. as the latter are approached. But a good chart and a fair degree of accuracy in dead reckoning will avoid confounding this with the decrease due to approaching ice. In the case of an iceberg stranded in a current, it is evident that even this valuable sign will fail on the current-washed side; so that when a vessel is running with an ocean-current where a berg is liable to ground, or where, from its great depth, the berg is subject to some more powerful under-current than exists on the surface, the only safeguard is in a vigilant lookout. A sailing-vessel, especially if she be small, should never approach an iceberg too closely, if there is any danger of becoming becalmed, especially in warm waters; as their disintegration, if of a colossal nature, is sufficient to throw quite a large ship on her beam ends, if taken at a disadvantage. Sir John Franklin had the ship's pinnace of the Trent thrown ninety-eight feet by the disruption of an iceberg about half a mile distant, which so completely stove the craft, that they were forced to a very annoying delay to repair it before they could return to the ship. This rupture had been determined by the firing of a musket by one of the party.

Even if there be a good wind, there is some danger in running under the lee of a large berg, the eddying of the wind forcing a ship on the ice, while if too near by, sailer or steamer, it is not impossible that their keel might meet one of the newly 'calved' icebergs that occasionly come boiling up from a great depth; in which case shipwreck would be almost inevitable to a ship taken at such a disadvantage.

Before discussing arctic navigation, as confined to the arctic region, something should be said regarding the variation of season. Nothing is more favorable to ice-navigation than a propi-

tious season; and the history of the polar zones is replete with instances where explorers at different times have found the most startling variations in the state of the ice in the same locality, and at the corresponding time of the year. So well is this fact appreciated by experienced navigators of these waters, that you

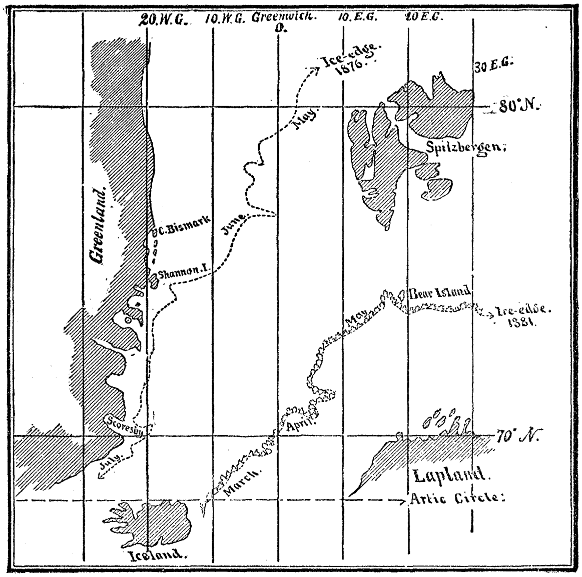


FIG. 1.—ICE-FIELDS IN 1876 AND 1881.

will seldom find one eager to give that credit to arctic nautical success so often fully accorded by the press and the public. Rightly estimating that it was not altogether superior management over his more unfortunate brethren, but largely due to the fortunate circumstance of a lucky season, which is a problem defying calculation, Lieut. Payer has pointedly said, "The commander of an expedition must possess sufficient self-control to return as soon as he becomes convinced of the existence of conditions unfavorable for navigation. It is better to repeat the same attempt on a second or even a third summer than with conscious impotence to fight against the supremacy of the ice." Splendid as this maxim appears upon the face of it, it nevertheless has the weak point, that it is based on things as they should be, rather than on things as they are; and should any arctic commander, actuated by honorable motives, adopt such a course, he would probably find this maxim, when he returns home, exchanged for, 'Nothing succeeds like success;' and, should the same attempt be repeated on a second or third year, it is more than doubtful if he would find himself retaining his original position. Nothing can show the variable state of the ice at different seasons so well as the accompanying map (fig. 1) of the ice-edge between Greenland and Spitzbergen, upon the authority of the Bremen geographical society's publications for 1876 and 1881. The explorer of 1876 would have been counted as a great success, and his equal brother of 1881, a failure.

The next difficulty encountered by a vessel will be the outlying ice-packs; and much has been said on this, while considering the relative merits of steam and sails (p. 506). The commander has now before him two general routes, one of which is to keep well out to sea, if the breadth of the channel will permit; and the other is to hug the shore-line. This point seems to be pretty well settled at this hour, and in favor of inshore navigation when in the vicinity of ice. Confirmed to a greater or less extent by Barentz, Hudson, Baffin, the two Rosses, and others, including the whalers constantly visiting these climes, it was reserved for Sir Edward Parry to bring the matter in such prominent light before the public as to provoke the most bitter discussion, and revive all previous experience on the subject, with the above result. Returning from his first voyage, he says, "Our experience, I think, has clearly shown, that the navigation of the polar seas can never be performed with any degree of certainty, without a continuity of land. It was only by watching the occasional openings between the ice and the shore, that our late progress to the westward was effected; and, had the land continued in the desired direction, there can be no question that we should have continued to advance, however slowly, toward the completion of our enterprise." In his second voyage he reiterates substantially the same opinion. So necessary was the continuity of land considered by the British admiralty, after Parry's deduction, that several expeditions were by them fitted out to explore the arctic coast-line of the American continent, in order to more intelligently direct a vessel through the northwest passage in conformity with this idea. One of the greatest advantages of coast-water navigation over that more remote, even when the latter is possible, is the assurance of a winter harbor, should the young ice form so rapidly as to prevent farther navigation, — a not unusual circumstance in these regions, where the change of season is short and decisive.

Another advantage is in the fact, that if the body of water in which the vessel is cruising be of considerable extent, and ploughed by ocean-currents, the ice well out to sea does not become fixed nor solidly frozen during even the severest winters; and a vessel thus embayed is at the mercy of the grinding ice-packs caused by the winds and currents at a time when, even if she were liberated, the intense cold of that season would make it rigidly impossible to manipulate her; and, in fact, a liberation under these circumstances would be the very last thing to be desired. The Tegetthoff and Jeannette, in their drifts, were thus partially fortunate, although suffering from constant dread of liberation; and Franklin's ships had the advantage that Victoria Channel, through which, it seems, they attempted to take the middle course, is sufficiently narrow to freeze from shore to shore, and prevent the miseries of a winter's drift. Sir George Back, in the Terror, drifting through Fox Channel and Hudson's Strait in the winter of 1836–37, did not fare so well; and his terrible sufferings, unable to house his vessel in snow-banks, which were constantly torn from his ship's sides by the ceaseless disruption of the ice-fields as fast as made, and many times forced, during heavy gales, to hastily abandon his ship, with a scanty supply of clothing and food, in the arctic winter night, expecting the crushing of his vessel in the whirling, upheaving ice-floes, show plainly the great extent of misery and sufferings which a crew may be called upon to bear when not safely harbored for the winter.

Another consideration on inshore navigation I will give in the words of its author, Lieut. Payer, who says, —

"A strip of open water, which retreats before the growth of the land-ice only in winter, forms itself along coasts, and especially under the lee of those exposed to marine currents running parallel to them; and this coast-water does not arise from the thawing of the ice through the great heat of the land, but from the land's being an immovable barrier against the wind, and therefore against ice-currents. The inconstancy of the wind, however, may baffle all the calculations of navigation; for coast-water, open as far as the eye can reach, may be filled with ice in a short time by a change of wind. Land-ice often remains on the coast, even during summer; and in this case there is nothing to be done but to find the open navigable water between the extreme edge of the fast-ice and the drift-ice. Should the drift become pack-ice, the moment must be awaited when winds setting in from the land carry off the masses of ice blocking the navigation. and open a passage free from ice, or at least only partially covered with drift-ice."

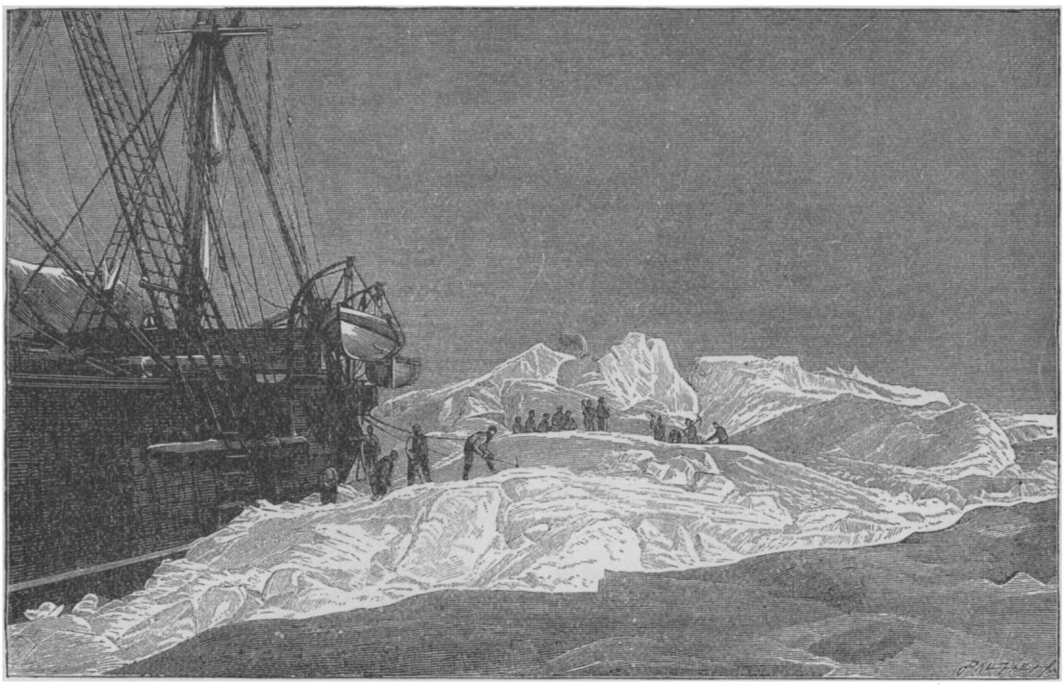


FIG. 2.—REDUCING A FLOE-BERG.

From all the above, it is evident that navigation in coast-waters must be slow and gradual, although it has always been attended with the greatest advantages. Inshore navigation is not without its hinderances, however, and especially is this the case where the water near the coast is very shallow; and this could be remedied only by a light-draught vessel, which has the disadvantage that such a vessel cannot conform to the build already indicated. This is especially the case on the polar shores of the mainland of America, Asia, and most of Europe, while in the channels and waters north of them the land rises higher, the navigable waters approach more closely to the shore, and progress forward becomes more easily assured. Also in coast-water cruising, a vessel forced upon the shore by the incoming pack, backed by a heavy gale, is in a more precarious state than one simply grounded or lifted upon an ice-field.

A ship once fairly beset, and strongly held during a gale, is completely beyond control; and no real good can be accomplished by the severe tasks of warping and continual shifting of ice-anchors, which only exhaust the crew, and render them more or less unable to take a thorough advantage of a favorable situation, should one occur. Parry, however, under these circumstances, did not hesitate to employ his crews to their utmost at the hawsers and sails, plainly acknowledging that "the exertions made by heaving at hawsers, or otherwise, are of little more service than in the occupation they furnished to the men's minds under such circumstances of difficulty; for, when the ice is fairly acting against the ship, ten times the strength and ingenuity could in reality avail nothing." But the greater majority of ice-navigators are now decidedly of the opinion that it is best to yield to fate, and reserve the men's strength for palpable efforts. Still, in these besetments the mind of the commander must be ever active; for new events follow each other so rapidly, that a favorable chance for rescue is passed, before it can be fairly weighed in all its aspects.

FREDERICK SCHWATKA.

NOTES ON HIBERNATING MAMMALS.

A VERY prevalent impression exists, that hibernation among mammals is so fixed a habit that it may be defined in a few words, that it occurs with all the regularity of sleep, and is as necessary to the creature's welfare as food or drink. So far as these hard and fast lines are drawn, so far is our understanding of the subject warped and imperfect.

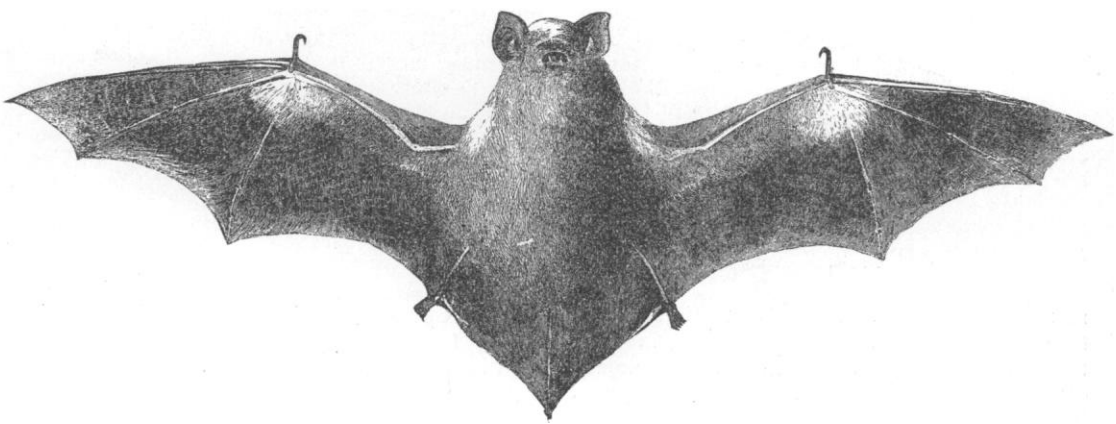
In the ninth edition of the Encyclopaedia Britannica, hibernation is defined as that "peculiar state of torpor in which many animals which inhabit cold or temperate climates pass the winter." Here we have the characteristic feature of the habit clearly expressed; but, when we come to consider the minor details, we do not find that any two animals, however closely allied, hibernate in precisely the same manner, nor do individuals of the same species always hibernate alike. Further, we do not find that it is so common an occurrence as usually supposed; and no animal appears to hibernate merely because winter has 'set in,' regardless of the temperature then prevailing. My own studies of the animal life in this neighborhood (central New Jersey) lead me to conclude, rather, that it is a happy faculty, which certain animals possess, but do not willingly exercise. If the prevailing temperature forces them, in self-defence, to hibernate, they can; but so long as they are able to withstand a low temperature, and food is accessible, they resist. Other causes than cold may induce an animal to hibernate; as when deprived of the supply of food gathered during the preceding autumn. In such a case, squirrels will pass the winter in a state of torpor, however mild the weather; while, with an abundant food-supply, they will simply sleep through the colder days, and awake to feast whenever the sun shines brightly.

Of the thirty or more mammals found here, thirteen species are supposed to be hibernating animals. These are four species of bats, two of moles, three squirrels, one ground squirrel, one marmot, one jumping-mouse, and one Hesperomys. Of these, probably the bats are the most sensitive to cold, and avoid exposure to it with the greatest care; and yet I find that the little red bat (Atalapha novaeboracensis) is very late in retiring for the season, and reappears with great regularity early in February. Their actions at this time indicate that considerable food is to be had, — that flying insects are abundant. While this bat's ordinary habits do not differ noticeably from those of the other species, it is apparently less sensitive to low temperature, and needs but the least encouragement to arouse from its hibernating sleep. It is also less crepuscular in habit than the others; but I do not know that this fact has any bearing upon the irregularity of its hibernation.

Bats disappear in November or December, immediately after the formation of ice, but do

not seem affected by a mere succession of hard frosts. As insect-life is not materially affected by the first few frosts, there does not seem any reason for their withdrawal from active life, and therefore it is not surprising that even up to Christmas, bats should be seen flying, at sunset, in considerable numbers. When the steady cold of an average winter fairly reaches us, bats hibernate in two ways. If they resort to the ordinary shelter of a hollow tree, or similar locality, that is considerably exposed to the wind, then many individuals cluster together; and contact is mutually beneficial, for the torpor of hibernation is not rapidly, but rather gradually acquired. Such clusters of bats, if disturbed immediately after gathering together, are as resentful as when captured during midsummer; and not until three or four days have elapsed do they become insensible to disturbance. If this be very violent, and the creatures roused suddenly, a curious condition of aimless activity ensues, but lasts for a short time only, and often ends in death.

On the other hand, I have very frequently found solitary bats in curiously out of the way places, where they were so protected that they could not have suffered from the severity of the season, however intense. In such cases the torpor was never profound, the temperature of the body but little reduced, and the heart's action almost normal. For instance: a single dusky bat (Vespertilio fuscus) slept, or hibernated, as described, for thirteen weeks, in the attic of my house. It clung to a nail driven into the wall of the chimney, and was protected by a piece of woollen cloth hanging from a beam above it. The chimney retained a little of the warmth derived from the three smoke-flues which passed through it, and which were in constant use during the time. This bat could be taken down and hung up as readily as an inanimate object, yet clearly showed that it was conscious of the disturbance to which it was subjected. Once I brought it into a warm room, when it revived in thirty minutes, and flew about the apartment, but not with a very steady, well-directed flight. When taken again to the attic, it responded to the effects of the lower temperature by resuming its former position, after a steady to and fro flight from end to end of the attic for nearly an hour. The bat seemed to be wholly aware of the position of the nail in the chimney, and, when wearied of its flight, turned to it directly, and, folding its wings about it, seized the nail with a tighter grip, and hung, head down, as it had been doing. In two hours I went to it again, and found it as indifferent to handling as before.



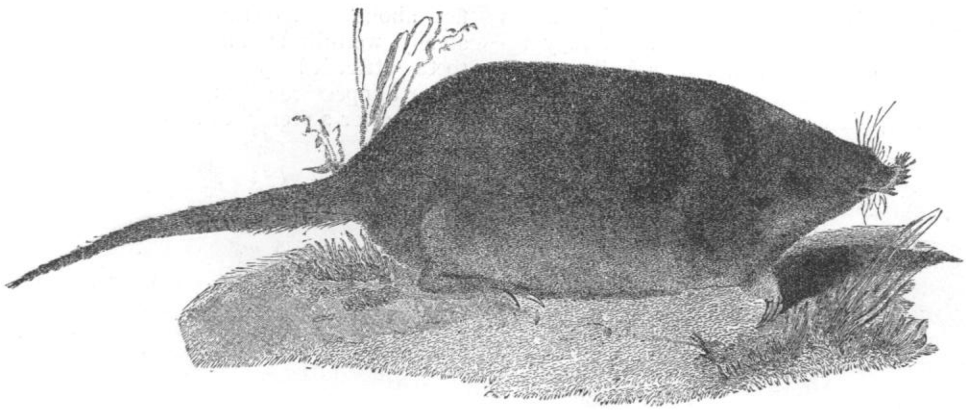
THE DUSKY BAT, VESPERTILIO FUSCUS (ONE-HALF NATURAL SIZE).

The two species of moles so common with us hibernate in quite different ways, the habit varying as much with them as does the character of their respective habitats.

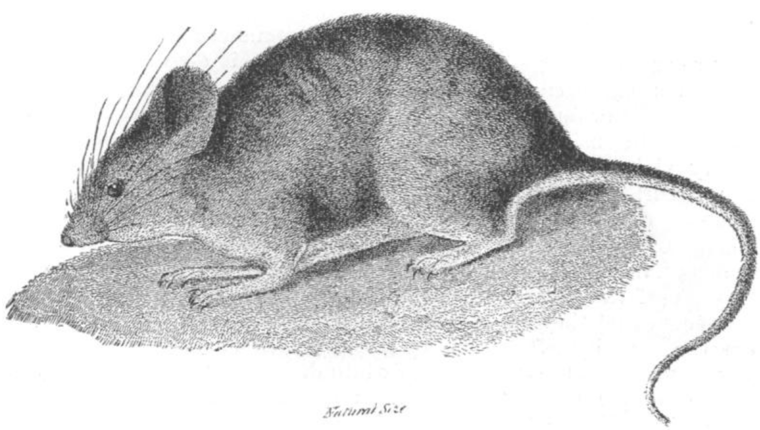
The common mole (Scalops aquaticus) — which, by the way, is in no sense aquatic — burrows deeply into dry soils, keeping just beyond the frost-line; and there it remains, without a nest of any kind, until the warmth of the spring sunshine melts the frost, loosens the soil, and sets the subterranean prisoner free. If, as sometimes happens, the cold is unusually intense and sudden, the ground freezes below the resting-places of the hibernating moles, and then they are frozen to death. This, I judge, does not often occur; but the approaching frost rouses them sufficiently to place them

on their guard, and forthwith they burrow a little deeper.

It is very different with the meadow-haunting, star-nosed mole (Condylura cristata). This mammal has more complicated burrows than those of the preceding, and often one or more openings to them are beneath the surface of the water. At some point in their tangled tunnellings, these moles form commodious nests, placing a good deal of fine grass in them. Here, indifferent to freshets, they remain all winter, and, as they can lay up no food, sleep, I suppose, through the entire season. The fact that these moles are unaffected by being submerged during the spring freshets is an interesting fact. So far as I have examined their nests, there was nothing to show that they were water-tight; and I think that the animals must have been thoroughly soaked for from forty-eight to seventy-two hours, the ordinary duration of the high water. If through any cause the period of submergence was prolonged, it is probable that it would prove fatal to the moles.



THE STAR-NOSED MOLE, CONDYLURA CRISTATA (FIVE-EIGHTHS NATURAL SIZE).



THE WHITE-FOOTED MOUSE, HESPEROMYS LEUCOPUS (NATURAL SIZE).

The short-tailed shrews (Blarina brevicauda), on the other hand, which are closely akin to the foregoing, are full of life and activity all winter. No severity of the weather chills their ardor; but this is not to be wondered at. Their favorite food is grasshoppers, and these are to be had in abundance the season through. Every warm day brings hundreds of half-grown, wingless grasshoppers to the surface, where they move about very actively. Feb. 3 of this year I found literally millions of them hopping over the dead grass, in the meadows, as restlessly as though it were August. The ground was frozen, and the sunlight had merely dried and warmed the tangled mat of dead grass upon the surface. At various points I found the openings of tunnels, which I took to be the pathways of the crepuscular shrews, — shy little creatures, that towards sunset come to the surface, and forage during the twilight.

Omitting reference to the winter habits of the familiar squirrels and woodchuck, or marmot, let us consider briefly the two small rodents found here, that are also hibernating

animals, — the jumping-mouse (Zapus hudsonius) and the white-footed mouse (Hesperomys leucopus). These two mice, popularly so called, hibernate with great regularity in one sense, but differ *inter se* in another. The former, once torpid, remain so until spring, a few warm days in winter failing to rouse them; but the white-footed mouse seems simply to sleep soundly rather than grow torpid, and responds with considerable promptness to any disturbance. The jumping-mouse builds a nest of leaves and grass at a considerable depth from the surface of the ground (not a 'ball of mud,' as stated in the Encyclopaedia Britannica, art. 'Jerboa'), and, once fairly settled therein, is beyond the various sudden changes of our winters: the white-footed mouse, on the contrary, utilizes an old bird's-nest, or has a resting-place beneath a log or in a half-decayed stump. In such positions, of course, the occupant is more likely to be disturbed, and is also directly exposed to the varying temperature.

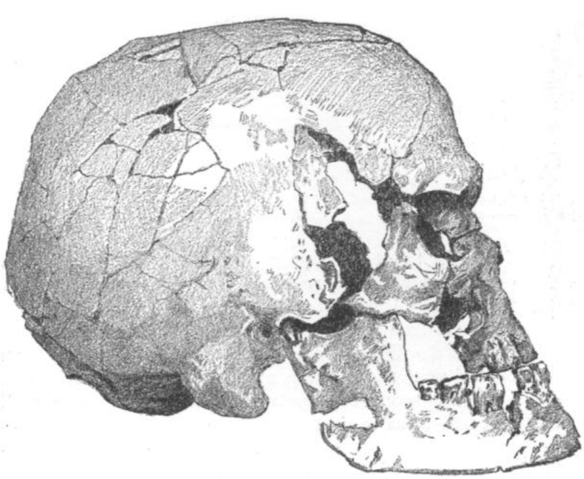


FIG. 2.

Is it to meet the requirements of this condition that this mouse lays up a goodly stock of food during autumn? — something the jerboa, or jumping-mouse, does not do. However this may be, the fact remains that both these rodents are quite sensitive to cold, and hibernate

FIG. 1.

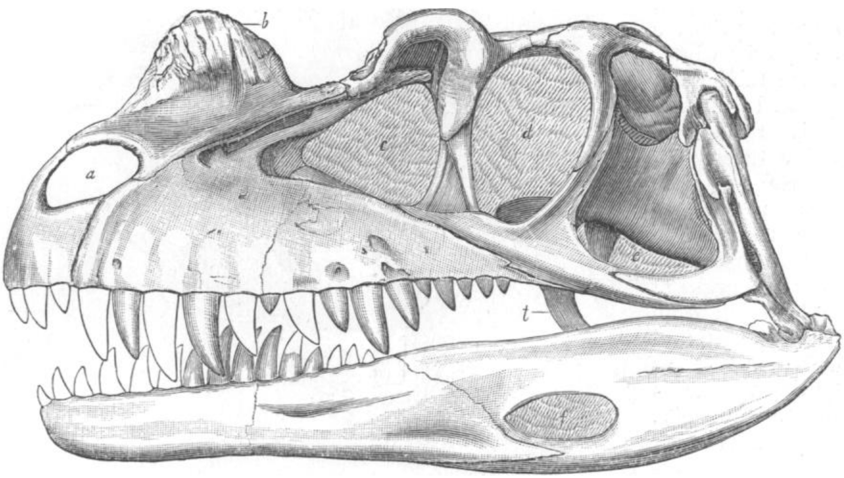
as soon as winter sets in; yet how very differently is this faculty exercised! C. C. ABBOTT.

ANOTHER ANCIENT HUMAN SKELETON FROM MENTONE, FRANCE.

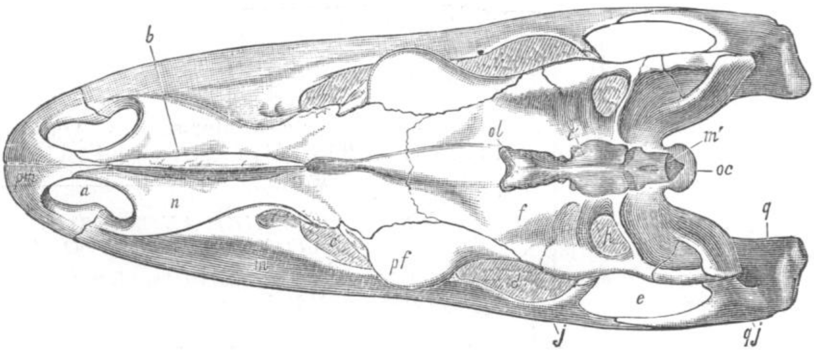
WE owe to the favor of Prof. Spencer F. Baird, secretary of the Smithsonian institution, photographs of a human skull exhumed last month from one of the grottos at Mentone, France (next to that in which Rivière discovered a skeleton twelve years ago), together with a letter from Hon. Thomas Wilson, U. S. consul at Nice, under date of March 31, from which we extract the following statements: —

The skeleton to which the skull belongs was found in the 'fourth cavern,' at a depth of eight metres and a half, under well-defined strata; one, a metre and a half thick, composed of cinders, ashes, burnt earth, and charcoal. More or less worked flint chips were found with it, comparing well with those found with Rivière's skeleton. The skeleton was complete; but, as the result of a quarrel over the ownership, the body was stolen, and its whereabouts are still unknown.

The skull was broken in the exhumation, but is nearly perfect; and, when found, a large flint chip was found resting against the top of the head, as shown in fig. 1, and two others resting like epaulets against the shoulders. The length of the skull, from the back of the head to the forehead, was eighteen centimetres, and from the back of the head to the projecting eyebrows, nineteen centimetres and a half: the breadth was fourteen centimetres. One femur was saved from loss, and measured forty-nine centimetres in length.



Skull of Ceratosaurus nasicornis Marsh; side view.



Skull of Ceratosaurus nasicornis Marsh; top view. *a*, nasal opening; *b*, horn-core; *c*, antorbital opening; *c′* cerebral hemispheres; *d*, orbit; *e*, lower temporal fossa; *f*, frontal bone; *h*, supra-temporal fossa; *j*, jugal bone; *m*, maxillary bone; *m′*, medulla; *n*, nasal bone; *oc*, occipital condyle; *ol*, olfactory lobes; *pf*, pre-frontal bone; *pm*, pre-maxillary bone; *q*, quadrate bone; *qj*, quadrato-jugal bone.

NEW JURASSIC DINOSAURS.

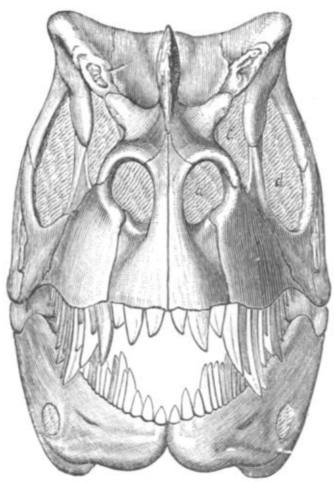
IN the *American journal of science* for April, Professor Marsh has given the principal characters of the Theropoda, a carnivorous order of dinosaurs, illustrated by numerous figures, several of which are here repeated.

Although much has been written about these reptiles since Buckland described Megalosaurus, in 1824, but little has been made out in regard to the structure of the skull, and many portions of the skeleton still remained to be determined.

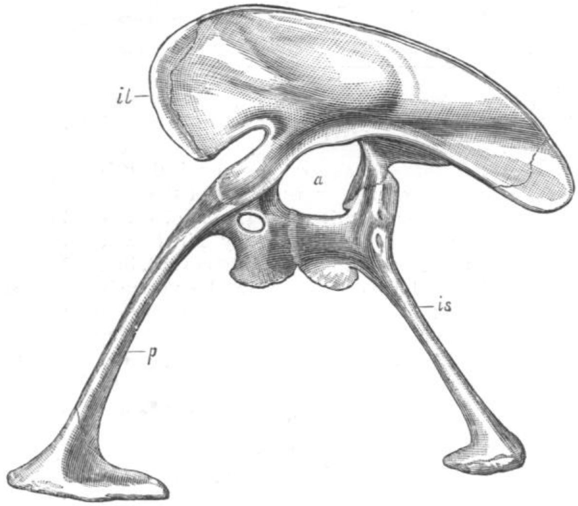
Of the carnivorous dinosaurs from the American Jurassic, there are apparently four distinct families, one of which is represented by Ceratosaurus, a new form here described. The nearly perfect skeleton of Ceratosaurus presents several characters not hitherto seen in the Dinosauria. One of them is a large horn on the skull; another is a new type of vertebra; and a third is seen in the pelvis, which has the bones all co-ossified, as in all known birds except Archaeopteryx. Another feature, not before known in carnivorous dinosaurs, is the presence of osseous dermal plates, extending from the skull over the vertebrae. This skeleton is over seventeen feet in length.

The skull of Ceratosaurus is very large in proportion to the rest of the skeleton. The posterior region is elevated, and moderately expanded transversely.

The facial portion is elongate, tapering gradually to the muzzle. Seen from above, the skull in out-



Skull of Ceratosaurus nasicornis Marsh; front view.

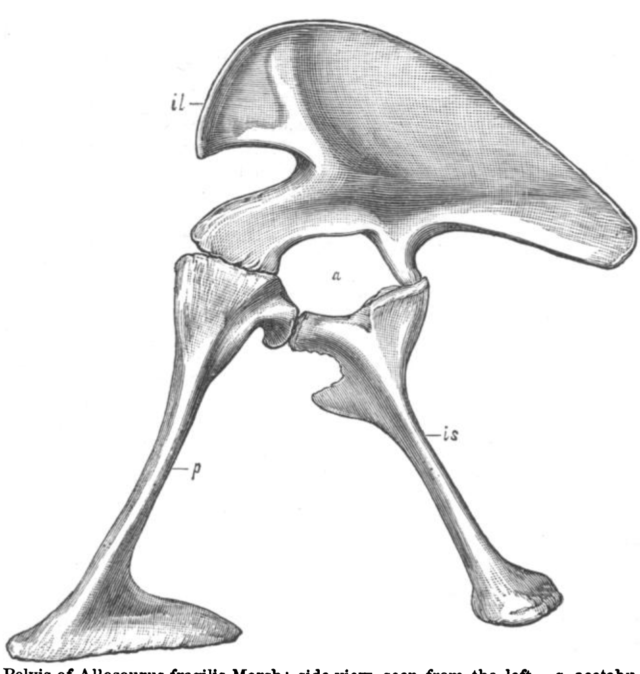


Pelvis of Ceratosaurus nasicornis Marsh; side view, seen from the left. *a*, acetabulum; *il*, ilium; *is*, ischium; *p*, pubis. One-twelfth natural size.

line is like that of a crocodile; seen from the side, it appears lacertilian in type, the general structure being light and open. The nasal bones support a large, compressed, elevated horn-core on the median line. It evidently supported a high trenchant horn, which must have formed a powerful weapon for offence and defence. The maxillary bones are large and massive, as are also the lower jaws. They are each provided with numerous teeth, which are large, powerful, and trenchant, indicating clearly the ferocious character of the animal when alive. There are, moreover, large protuberances partially overlying the orbits, which they doubtless served to protect. The brain was of medium size, but comparatively much larger than in the herbivorous dinosaurs: it was quite elongate, and situated obliquely in the skull. The foramen magnum is small. The cerebellum was of moderate size. The optic lobes were well developed, and proportionally larger than the hemispheres. The olfactory lobes were large and expanded. The pituitary body appears to have been large.

The cervical vertebrae differ in type from those of any other known reptiles, being deeply concave behind, but flattened in front, leaving only a narrow margin for articulation.

The bones of the pelvis, except the sacrum, are all thoroughly co-ossified. The pelvis is extremely narrow, being in striking contrast to the width in this region in the herbivorous forms found with them. Some facts seem to indicate that they were viviparous. The pubes were long, and firmly united for the greater part of their length, terminating below in a large, massive, foot-like body, which probably served to support the animal when sitting down.



Pelvis of Allosaurus fragilis Marsh; side view, seen from the left. *a*, acetabulum; *il*, ilium; *is*, ischium; *p*, pubis.

Restorations of the fore and hind legs of Allosaurus are given. They are remarkable for the great disparity in size. A new classification of the order Theropoda is also proposed, including the European as well as the American forms.

THE ASTRONOMICAL LABORS OF MR. COMMON.

IN his address before the Royal astronomical society in February last, on the presentation of the gold medal to Mr. Common for his photographs of celestial bodies, the president of the society, Mr. Stone, remarked that the council, in making the award, had been less influenced by originality in the methods adopted than by the great practical success which has attended his efforts in this field of astronomical research. It will be of interest to note a few points, relating to the labors of Mr. Common, which have contributed more or less directly to the importance of his results.

He began celestial photography about ten years ago, with a small refractor of five and a half inches aperture. In 1877 he supplied himself with an eighteen-inch mirror by Calver, the mounting for which was designed by himself, and executed under his direct personal superintendence. In a paper presented to the Royal astronomical society in 1879, he laid down certain assumedly proper conditions to be fulfilled in the mounting of large reflectors, according to which he was proceeding with the construction of an exceedingly powerful telescope, and among which were the following: —

1°. No tube properly so-called. 2°. No mass of metal either below or at the side of the line joining the large and small mirrors. 3°. An equatorial mounting capable of direction to any part of the visible heavens, and of continued observation past the meridian without reversal. 4°. An efficient means of supporting the mirror without flexure. 5°. Driving-clock, circles to find or identify an object, and motions taken to eye-end. 6°. A collimator for the ready adjustment of the mirrors. 7°. Such a construction of mounting as to give the greatest amount of steadiness with the least amount of friction. 8°. An efficient means of resilvering the mirrors and of protecting them from dew. 9°. A safe, steady, and easily adjusted platform for the observer, allowing about two hours continuous observation without the necessity of any motion except that from the observer's place, and of easy access.

In designing a mounting to satisfy these conditions, Mr. Common made such departures from the old form of mounting and platform, that an account of it was deemed worthy of a place in the Memoirs of the Royal astronomical society, where may be found (vol. xlvi. p. 173) a description of his instrument, together with fully detailed drawings suited not only for his, but also for a much larger telescope. In the actual construction of the thirty-six inch reflector, the cost was kept down as much as possible without sacrificing any essential points, all elaborate mechanical arrangements coming under the head of mere luxuries being avoided. Both the telescope and its house were so contrived as to be completely under the management of one person.

The difficulties which Mr. Common surmounted in the construction of his telescope were of the most discouraging nature, — in fact, unique. Just as the great speculum — a lump of glass of about thirty-eight inches diameter, and seven inches thickness — was ready to receive its final figure in the hands of the optician, it burst into a thousand pieces with a terrific explosion. Within a few hours time, Mr. Common had telegraphed to the glass-makers in Paris for two more disks of like dimensions, the extra one to be brought into service in case of another explosion. The second disk, however, was successfully ground, polished, and mounted ready for work, about the middle of 1879, and it is with this instrument that Mr. Common has carried on his unequalled researches. In some respects it is proper to call it the most powerful telescope in existence, although the great refractor of thirty inches aperture, now being mounted near St. Petersburg, may be expected to surpass it.

A description of Mr. Common's novel plan for silvering large mirrors may be found in vol. xlii. of the *Monthly notices* of the Royal astronomical society, at p. 79.

Of the mounting of Mr. Common's reflector, Mr. Stone remarks, that it shows in every direction great engineering-skill, guided by the experience, gained in the use of the smaller instruments, of the actual requirements for successful astronomical work. The method of relieving the friction of the polar or main axis of the instrument deserves especial attention, and is fully dealt with in his memoir. Mr. Common alluded, in this publication, to the fact that this principle is equally applicable to other astronomical instruments of large dimensions; and at the meeting of the Royal astronomical society, March, 1884, he presented plans for a large transit circle in which mercury-troughs are used to sustain the weight of the tube when in certain positions. By these means he believes that flexure may be practically eliminated.

Early in 1880 Mr. Common attempted to photograph the great nebula of Orion; the result being a failure, as the stars appeared on the plate as lines, and the nebula had impressed itself only as a faint stain. But such failures only suggested the necessity of improved clock-driving, and the use of more sensitive plates. In June, 1881, Mr. Common obtained a successful photograph of comet (*b*) of that year; and, in March of the year following, a photograph of the nebula of Orion, which excited the admiration of all the astronomers who had an opportunity of inspecting it. He continued, however, to push the refinements of his photographic and instrumental equipment to a farther limit, and obtained on the 30th of January, 1883, a photograph of the nebula, with an exposure of thirty-seven minutes, a carbon enlargement from the negative of which was presented to the Royal astronomical society in the March following. This photograph showed a marked advance on

all his previous ones, and gave evidence of a time approaching when the shapes of nebulae, and the relative brightness of the different parts, will be recorded photographically in a better manner than by the most careful hand-drawings. The behavior of the very faint stars in the nebula also led to results of the greatest interest. These stars appear on his negatives taken with exposures of from thirty-seven to sixty minutes; and, as the time of exposure can be easily extended to hours, Mr. Common thinks it quite possible to get stars invisible to the eye in the same telescope used for photography. Mr. Common has already experimented with the longer exposures, and more details are brought out with every increase of the time; and it appears that the extreme limit of useful exposure has not even been reached at an hour and thirty minutes.

Mr. Common has also obtained beautiful photographs of other nebulae and of the planets Jupiter and Saturn, and has also applied himself successfully to obtaining photographic star-maps to stars of the eleventh magnitude.

In connection with all this variety of valuable astronomical work, it should be noted that Mr. Common belongs properly to the ranks of amateur astronomers; and this fact was dwelt upon at some length by Mr. Stone, at the conclusion of his address, as follows: —

"The lesson taught is not a new one. The records of our society are rich in the labors of our amateur astronomers. The amateur who can provide himself with sufficient instrumental means for original research need fear no professional rivalry. Untrammelled by the necessity of continuing observations whose value largely depends on their continuity, having the power of taking up any subject he pleases, without fear or responsibility of charges of wasted time and wasted means, he possesses advantages which are priceless in the tentative and experimental stages of any work.

"It is in work of this class that the most striking advantages in our science must be expected; and such work will most certainly repay, by the gratification of personal success, the efforts of those who devote themselves to original work in our science; and the field of research presented is absolutely boundless."

INSECTS AND FERMENTATION.

THANKS to a long line of investigators and experimenters, beginning with Sprengel, and including among its recent leaders Darwin and Hermann Müller, we know that very intricate relations exist between flowering plants and insects which result to the advantage of both; many insects obtaining their food exclusively, or in large part, from the nectar and pollen of flowers, which are strengthened by intercrossing as a result of their visits. Within the last few years the activity of insects has also been shown to have a close connection with the distribution of other and lower organisms. The fetid slime of phalloids has long been known to be attractive to many flies and scavenger-beetles; and, as Mr. Gerard suggests in the case of the common stinkhorn (Phallus impudicus), the dissemination of these fungi is largely traceable to such insects. Rathay has likewise shown that a partnership of a somewhat similar nature probably exists between some of the rust fungi (Roestelia, Aecidium), and insects which feed upon the sweet secretion that accompanies their spermatia. In these cases the arrangement appears to be mutually beneficial. In the last it may also favor the spread of diseases of the higher plants, and so lead to important indirect results. Zymotic diseases of man and the domesticated animals are also known to be carried by the same active agents, which, however, appear to be rather accidental than specially provided for; while, in the asserted intervention of mosquitoes in the parasitism of Filaria, they are decidedly losers by their part in the transaction.

Boutroux has recently shown[1] that insects also play a very important, if indirect, *rôle* in the life-history of yeasts. It has been generally asserted that the agents of spontaneous fruit-fermentations, like those employed in the manufacture of wine and cider, are found on the surface of the ripe fruit, whence they readily reach the expressed juice. Boutroux was led to investigate their occurrence not only on ripe fruits, but on those which were immature, as well as in the saccharine secretions of flowers and on the bodies of the insects which visit both classes of objects. He prepared tubes of sterilized cherry-juice, or other fermentable liquid, from which germs were excluded by means of cotton. After these had shown their freedom from yeast by remaining unchanged for a fortnight, at a temperature favorable for fermentation, a fruit, flower, or insect was introduced into each, precautions being taken to prevent the introduction of germs from other sources. Repeated transfers were made from these first propagation cultures, where several species were usually found, until these were isolated, when their form and physiological characters were studied.

Contrary to the prevalent opinion, it was found that ripe fruits, as long as they are intact, bear comparatively few yeast-germs, these being much more frequent on green fruit, as well as in the nectar of flowers and on the bodies of the insects which are common about flowers. From what appears to have been a careful series of experiments, Boutroux advances the opinion that these spontaneous yeasts are regular inhabitants of nectar, being carried from flower to flower by insects in their visits for this beverage. After the fading of the flower, especially where some of its organs persist on the ripening fruit, they remain, the number of germs suffering constant diminution from rain and other causes. When the fruit has ripened, a few of these germs may still be present; while others are brought from later flowers, or from injured and fermenting fruit, by insects which feed upon the juices of the latter. The hibernation of these species is thought to occur on the remains of fallen fruit, as well as in the ground, whence a new supply is obtained the next spring. It is interesting to note that the species which have been obtained in these cultures are not identical with the wine and cider ferments, although some of them resemble these closely; and it is suggested, that, while

[1] *Ann. des sci. naturelles, Bot.*, 6 sér., v., xvii., p. 144.

these species are undoubtedly derived from the surface of the ripe fruit, their germs are extremely rare, though capable of rapid multiplication when once introduced into the must. W. Trelease.

THE VARIATION OF TEMPERATURE IN GERMANY.[1]

Dr. Hellmann has, by this paper, added another to the already large list of climatological contributions which have appeared in the German language. Such papers can and ought to serve as models for the uses to which the data secured in our own country should be put; and although we may have no particular interest in the climatical relations which exist in a certain part of Europe, yet each paper of the nature of the present should be carefully examined as to method, if not for results.

In 1874 there was given in this same publication an article on the climatology of Germany; and this contained the mean temperature for the twenty-five years from 1848 to 1872 of the stations connected with the Prussian meteorological institute. Hellmann has made a new discussion of these temperatures, and has included in this the ten years extending from 1872 to 1882. He has chosen to put the observations into five-day periods; and, using these means in his discussion, he proceeds, by means of combining certain stations, to show what deductions he can draw from the material at his disposal. The twenty-five stations he divides into seven districts, which have recognizably different meteorological conditions; and these stations are quite evenly distributed. Of the twenty-five, only ten were complete in their meteorological data; but the lacking observations have been filled in, and the error of this reduction will not exceed 0.2° C. Hellmann then proceeds to give the missing dates for the various stations. The observations were made at six, two, and ten, with one exception; and he deplores the fact that the lack of good hourly observations does not allow the reduction of these to a true daily mean. The temperatures for the various places are plotted, and curves drawn, on the same page, so that they can be easily compared with each other; and the curves are, in general, similar. The author brings out the fact that "unperiodic weather characteristics are not of a local nature, but occur at the same time over large areas." He also shows that the yearly extremes increase as we proceed inland. With three exceptions, the coldest weather occurred in the five days between Jan. 11 and Jan. 15, but the warmest weather does not occur in all at the same time: this varies from July 17 to July 27. Hellmann goes into a detailed discussion of this difference and the reason. He remarks that Wargentin, in 1760, was the first to use the mean temperature for five-day periods in showing the yearly rate. The temperature-curves of Breslau for ninety-two years and for thirty-five years are compared. An interesting table is given in which the probability is computed that each succeeding five days will be colder from January to August, and warmer from August to January. The periodic return of colder weather is carefully examined and commented on in detail.

At the end of five pages of text we find six pages of tables, containing the five-day means for each of the stations from 1848 to 1882; then comes the graphical representation of this as already mentioned, and next a number of curves showing the relations of the air-pressure, temperature, rain, and probability of succeeding cold at Breslau from 1848 to 1882, and then curves showing the temperature for May and June for Breslau for each year of this same period.

F. W.

[1] *Ueber den jährlichen gang der temperatur in Norddeutschland.* By Dr. G. Hellmann. From the *Zeitschrift der Königlich preussischen statistischen bureau's, jahrgang* 1883.

LOUIS PASTEUR.

M. Pasteur. Histoire d'un savant, par un ignorant. Paris, *Hetzel*, 1883. 14+392 p. 16°.

It is the fashion at present to tell the unfinished histories of living men. Noteworthy literary characters have been of late studied, weighed, almost vivisected; and now science pauses to listen to the life-history of one of her living masters. Let us be thankful, however, that we are not yet asked to take the measure of our friend before his death. On the contrary, we are only invited to draw our chairs about the fireside, while a mutual friend discourses to us, half aloud, and half in confidence, about the man and the scholar, Louis Pasteur.

The book whose title stands above has caused much comment on the continent and in England; so much, indeed, that an English translation is already announced, for which, rumor has it, we are indebted to Professor Tyndall, always a warm admirer of Pasteur. Some of the Parisian correspondents of journals published elsewhere have apparently been much impressed by the book, and have written elaborate reviews of it.

The author of this little history modestly professes to be '*un ignorant*,' whose only merit is that he appreciates the master. On laying down the book, we cannot believe that he really deserves his chosen title, for he has certainly mastered the master himself. However, we shall not quarrel with him, especially since he is now known to be the son-in-law of Pasteur, but shall rather thank him for the labor of love and enthusiasm which he has done so well. As has been hinted above, the author has given a familiar account of the life and labors of Pasteur. The book is not a 'critical examination:' it is, rather, a fascinating story. Of course, from the rigid scientific stand-point, it is one-sided and partial. Objectors and ob-

jections are seldom adequately recognized and met. Liebig gets fuller treatment than most; while Schützenberger, Koch, and Berthelot are either passed with a light touch or altogether ignored. Much of the story gives the impression of a comparatively quiet and always triumphant life, flowing smoothly on, — a stream of brilliant scientific conquest, unrippled by blunders, and unchallenged by the incredulous. But the initiated know that the course of true science, like that of true love, never runs smooth, though both are probably all the more interesting on that account.

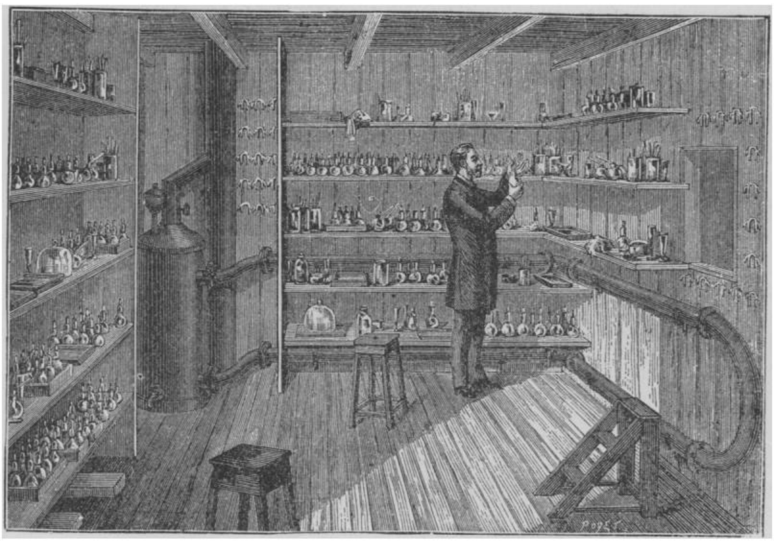
Louis Pasteur was born in Dôle, Dec. 27, 1822. His father, who had been an honorable soldier, had settled down as a tanner, but he appears to have had an earnest desire that his boy Louis should become a scholar. "Ah!" said the father over and over again to the young boy, "if you could only become a professor some day, and a professor in the college of Arbois, I should be the happiest man in the world." Little did the father think that his son would be professor — not at the humble Arbois, but in the École normale de Paris.

In 1842 young Pasteur was examined for entrance to the École normale. He was admitted, but stood fourteenth; whereupon he voluntarily spent a year in more careful preparation, and then, in 1843, entered the École, now standing fourth among the candidates.

Chemistry had already become a passion with him; and under Dumas at the Sorbonne, and Balard at the École, he had ample opportunity for following his bent: "M. Dumas, with his serene gravity, . . . never letting the least inaccuracy slip into his words or his experiments; M. Balard, with boyish vivacity, . . . not always giving his words time to follow his thoughts."

Under Delafosse, Pasteur now became absorbed in molecular physics, and finally met with an anomaly pointed out by Mitscherlich; viz., that while the tartrates and paratartrates of sodium and ammonium are in nearly all respects alike, they yet act differently upon polarized light. This anomaly fastened itself in the fresh mind of Pasteur, and eventually led him to his views on dissymmetry, which are here given at great length.

While still absorbed in molecular physics, Pasteur was appointed assistant professor at Strasbourg, where he carried on the same studies. "To interrupt these required nothing less than his marriage with Mlle. Marie Laurent, the daughter of the rector of the academy. Indeed, it is said, that, on the morning of the wedding-day, some one had to go to the laboratory to remind M. Pasteur that it was the day on which he was to be married." The author assures us, however, that he has proved to be so good a husband, that Madame Pasteur listens to the story now with an indulgent smile.

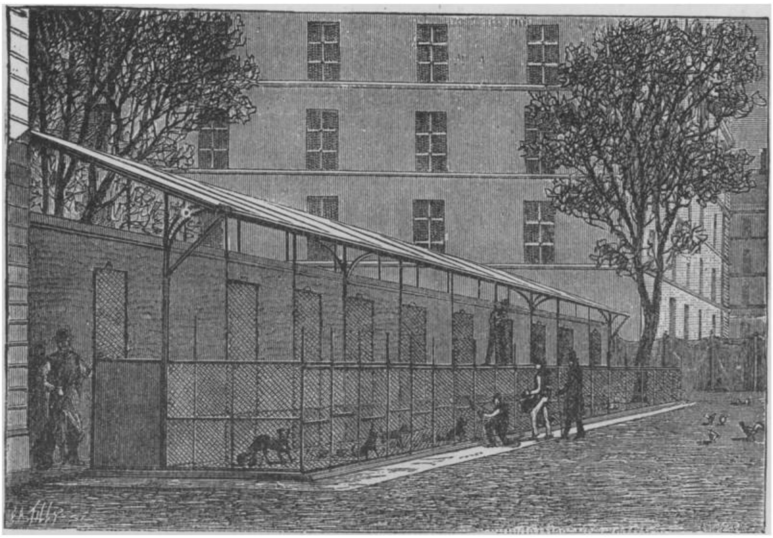


THE WARM ROOM FOR THE CULTURE OF MICROBES.

In 1854 Pasteur was appointed dean of the faculty of sciences at Lille. He was then thirty-two years of age, and almost wildly enthusiastic over molecular physics. But as a matter of policy, for the sake of drawing the attention of the neighborhood to the new faculty, he resolved to lecture, for at least a part of every session, upon fermentation, because the making of alcohol was a prominent industry thereabouts.

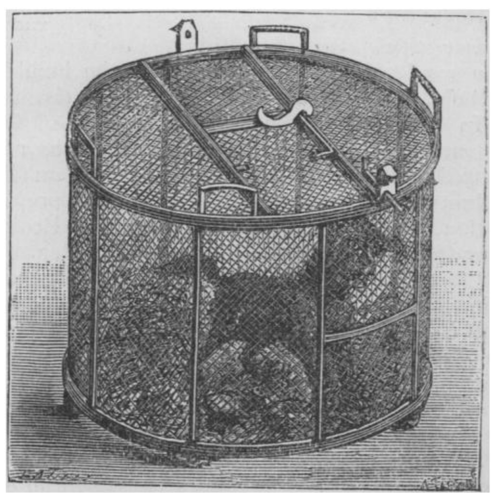
From this time on, Pasteur's history is more familiar. Fermentations, spontaneous generation, wine, vinegar, the silk-worm disease, splenic-fever, chicken-cholera, hydrophobia, and vaccination have been successively studied by him, and many of them much elucidated.

In the present volume their history is given in very interesting detail, which, however, time does not permit us to consider. By no means all of his views are accepted or acceptable; but in the distinguished professor — now of the École normale, and Membre de l'Institut — we have a very brilliant example of a man of science who has finally attained great and deserved fame. If its coming was slow, it was sure; and scientific men have often had to wait for '*le grand public.*'



KENNELS FOR MAD DOGS.

The last chapter of the book describes the biological laboratory of the École normale. Under Pasteur's control, its funds have been made ample by the liberality both of the government and of the municipal council of Paris. The garden of the old Collége Rollin has been placed at his disposal; and here Pasteur has provided stables for horses having the glanders, sheep-pens for sheep attacked by splenic-fever, and kennels for dogs mad with rabies. In the cellars beneath his laboratory in the Rue d'Ulm dwells a shifting population, a sort of unhappy family of animals undergoing experiment. The author dryly remarks, that the mad dogs are not particularly re-assuring to the spectator, as they furiously bite the iron bars of their cages. While some, however, are furious, and given to lugubrious barking, others are still unconscious of the fatal germ that is developing within them. Here are families of fowls, rabbits, guinea-pigs, and little white mice, all destined for inoculation experiments. Every morning a tour of inspection is made, and the dead are removed to the rooms above for dissection and examination. Some of the animals are also brought up from time to time for vivisection. But in Pasteur's laboratory 'every vivisected dog is a chloroformed dog.' He states very emphatically, however, that, though he "would never have the courage to kill a bird for sport, in the cause of science he has no scruples." Distributed about the laboratory and offices are panniers and boxes, some of great size, wrapped in straw, and containing the carcasses of animals (sent from all parts of France, and, indeed, of the world) which have died of various diseases. In fact, there seems to be a regular delivery at the laboratory, not only of these Christmas-like hampers, but of small tin boxes and carefully packed phials, containing such precious gifts, by foreign *savants*, as yellow-fever secretions from Brazil, or possibly cholera-germs from India. Perhaps the most curious sight is the large number of glass tubes distributed everywhere through the laboratory. In the solutions contained in the tubes, swarm millions and mil-



CAGE FOR A MAD DOG.

lions of microbes in various stages of 'attenuation;' and a prick from a pin-point dipped in any one of them might confer a horrible disease or future immunity from it. Yet in the midst of such dread possibilities the devoted experimentalist moves unharmed.

The closing paragraph runs as follows: "At this very moment experiments [upon the prevention of hydrophobia] are under full headway. Biting dogs and bitten dogs fill the laboratory. Without reckoning the hundreds of dogs which within three years have died mad in the laboratory, there is not a case discovered in Paris of which Pasteur is not notified. 'A poodle and a bull-dog [*bouledogue*] in the height of an attack; come!' was a telegram sent to him recently." Pasteur went, and took our author with him. The two dogs were rabid '*au dernier point*,' and it was only after some time and no small trouble that they were bound securely to a table. M. Pasteur then bent over the frothing head of the bull-dog, and sucked into a pipette a few drops of saliva. Our author remarks, in conclusion, that Pasteur never appeared to him so great as in the cellar where this took place, and while this '*tête-à-tête formidable*' was being enacted.

PLANTÉ'S RESEARCHES.

Recherches sur l'électricité, de 1859 à 1879. Par GASTON PLANTÉ. Paris, *La lumière électrique*, 1883. 5+322 p. 8°.

THE great interest taken in electric accumulators since Faure brought out his secondary battery, in 1881, has doubtless led to this reprint of Planté's researches from the text of the first edition, published in 1879, and two supplementary papers issued a few months later. These researches, extending over a period of twenty years, are characterized by a neatness and originality that make them very attractive. The writer considered himself specially fortunate in receiving a cordial invitation from M. Planté, in 1881, to witness many of the most interesting experiments described in this book. A review of them recalls vividly the pleasure experienced in Planté's laboratory, near the celebrated 'Place de la Bastille.'

A *diplôme d'honneur* was most worthily conferred on M. Planté at the Paris exposition of electricity, in recognition of his labors as the inventor of the secondary battery; for, while polarization currents had been observed by other physicists previous to the beginning of his work in 1859, no one had pursued the investigation with sufficient patience to make the principle of any special value. It is entirely safe to say now, however, — in view, too, of all that inventors have done within the past three years, — that no one can make a special study of secondary batteries, or succeed in making efficient ones, without going to these researches of Planté for the most essential part of his information. As a purely experimental series, they must take rank with the best in the domain of physics.

It is to be regretted that M. Planté has not revised those portions of his researches relating to the chemical reactions taking place during the charging of the cell and its discharge. His explanation of the formation of the peroxide of lead on one plate, and of spongy lead on the other, has the merit of simplicity at least; but, in the light of Gladstone and Tribe's[1] investigations, it must be considered as entirely too simple to accord with the facts. No mention is made, in these researches, of the formation of lead sulphate; and yet its presence is fully established, and the part it plays in local action is clearly demonstrated. The slow conversion of the peroxide into sulphate on the negative plate, with the circuit open, explains the gradual fall of electromotive force; while the residual charge appears to be fully accounted for by the two related facts of the formation of a small amount of peroxide on the positive plate during the discharge, producing electrical equilibrium before the peroxide on the negative plate is exhausted, and the subsequent conversion of this peroxide into sulphate, thus re-establishing a difference of potential. The formation of highly resistant sulphate from peroxide on the negative plate, and from metallic lead on the positive, accounts for Planté's observation that a cell long disused acquires great internal resistance, and charges again with difficulty. It seems highly probable, however, that the skill acquired by Planté in 'forming' his cells enables him to so modify the physical character of the surfaces of the lead plates that the sulphate plays a less important part in the final chemical action in his cell than it does in the experiments of less skilled physicists. Thus Professor Barker says of one of his Planté cells, "Not a trace of sulphate has been formed in it apparently, though it has been in use for six months."[2]

It would be pleasant to express as high an opinion of M. Planté's explanations of electrical phenomena in nature as of his researches: but this is impossible; for while he gives a possible explanation of ball-lightning, and other

[1] *Nature*, xxv. 221, 461; xxvi. 251, 602.
[2] *Proc. Amer. assoc.*, xxxi. 217.

forms of electric discharge from the clouds, it is none the less unsatisfactory to be told that atmospheric electricity arises from the earth's possessing a constant positive charge. Again: the theory that the sun is only one of a *chapelet de grains brillants* originally fused by a powerful current like the globules formed by a melting wire, and that "the incandescence of the solar globe, prolonged during a long series of ages, is itself only a spark of short duration in the infinity of time and space" (p. 250), is not worthy to stand in connection with the account of his many remarkable investigations. These furnish no basis for such a speculation, and scarcely more for the theory that "whirlwinds and cyclones are the powerful electro-dynamic effects produced by the combined forces of atmospheric electricity and terrestrial magnetism" (p. 229).

In conclusion, M. Planté says, respecting the nature of electricity, that it "may be considered as a motion of ponderable matter, — motion of transport of a very small mass of matter, animated by a very great velocity if an electrical discharge is considered, and a very rapid vibratory motion of the molecules of matter if its transmission to a distance under the dynamic form, or its manifestation under the static form, at the surface of bodies, is considered" (p. 314). Without adopting this view, we may say that many of Planté's experiments strongly support it.

THE CHILIAN LANGUAGES.

Chilidúgu sive tractatus linguae chilensis. Opera BERNARDI HAVESTADT. Editionem novam immutatam curavit Dr. JULIUS PLATZMANN. 2 vols. Lipsiae, *Teubner*, 1883. 952 p. 12°.

THIS is the general title of Platzmann's neat facsimile reprint of an important publication of the eighteenth century which had become quite scarce. Havestadt was a Jesuit, born in the environs of Cologne, on the Rhine, and a man of considerable learning, — a fact which appears not only from the fluent and elegant Latin style in which his manuals are composed, but also from the few leaves which he devotes to an autobiographic notice. The travels performed by him (1751–52) in his Chilian diocese on the western slope and in the higher valleys of the Andes are described in vivid colors by himself, and illustrated by a quaint map, which fully deserves the attention of ethnographers. The missionary's work was originally published (in 1777) with several sub-titles, which are faithfully reproduced in the reprint with all the saints' images, heraldry, etc., and embrace the following parts: Chilian grammar; three vocabularies; catechism, with Latin translation, and hymns in Chilian, to which music-notes are added; and a diary.

The phonetic system of Chilidúgu (*dúgu*, 'language') is described with laudable accuracy by the padre, who marks forty different sounds as constituting its alphabet. The language evinces some tendency towards nasalization of the consonantic elements, but is of an easy and harmonious pronunciation, and shows some general resemblance to Quichhua and Aimará phonetics. A peculiarity not very often found in American languages is the dual, which here pervades the verb and pronoun as well as the noun. According to the custom of his epoch, Havestadt arranged the forms discovered in this southern language wholly after the pattern of the Latin grammar. He found six cases in the noun; but his paradigms conclusively show that his nominative is identical with his accusative and vocative, his dative the same form as his ablative. Whether these cases are formed by postpositions, or by real case-affixes, remains to be examined. The verb inflects with remarkable regularity, forms five tenses and an intricate array of verbals (nominal forms of the verb, gerunds, etc.), has an interrogative, affirmative, negative, and passive form, together with an extensive system of transitions. A large number of suffixes serves to form derivatives, verbal as well as nominal, from verbal and nominal bases. In his rich collection of conversational phrases, the author has given a powerful and safe guide for the study of this sonorous tongue, which he extols in such a manner as to make it "surpass in excellence and graphic power all other languages of the world." The vocabularies given by Havestadt are more copious than that of Febres and the other authors who have written upon the Chilidúgu. The dialect of Chilidúgu, treated by Havestadt, is that of the Molu-che tribe.

THE IRON AND STEEL INSTITUTE.

The journal of the Iron and steel institute. Vols. i. and ii. London, *Spon*, 1883. 10+484, 405 p. 8°.

THE proceedings of the Iron and steel institute cannot fail to be of interest to the general scientific public, and especially so to the workers and manufacturers of iron and steel, since the society numbers among its active members such men as Sir Henry Bessemer, Mr. Sidney G. Thomas, and Mr. I. Lowthian Bell. The late C. W. Siemens was one of the prominent members and contributors. The

papers read and discussed at the meetings held during the last fourteen years cover not only the practical, but the theoretical ground of the iron-manufacture.

As its name indicates, this society confines itself to the consideration of iron and steel, and allied subjects. In the volumes before us we have sixteen papers, which, with the discussions, occupy 389 pages. There are 43 plates of illustrations. The remainder of the volumes, 400 pages in all, consists of notes on the progress of the iron and steel industries of the United Kingdom and of foreign countries. These notes are arranged for the different countries under the following heads: ores and fuel, blast-furnace practice, manufacture of steel, manufacture of iron, mechanical and physical properties of iron and steel, chemical properties of iron and steel, statistics. These notes contain also summaries of important papers in foreign publications.

The most valuable papers in these volumes, those on the temperature best for the greatest production of iron at least expense of coke, and on coke and gaseous fuel, have been noticed already in *Science*, Nos. 33, 50, and 59.

Vol. i. opens with a discussion on Mr. G. J. Snelus's paper on the physical and chemical characters of iron and steel. In view of the great increase of attention paid to this subject, the points of the discussion are worth a moment's notice. One of the more important points to be settled is the relation of the chemical composition and the physical treatment, hammering, heating, compression, etc., to the toughness and durability of steel used for rails and machinery.

The first researches on the subject seem to have been those of Messrs. J. T. Smith and Price Williams (*Proc. inst. civ. eng.*, 1875–76). The conclusion arrived at, that soft rails low in carbon resisted wear better than harder rails high in carbon, was contrary to the general opinion of metallurgists and engineers, which had been, that steel would wear better, the harder it was. C. B. Dudley's investigations in 1878 and 1880 (*Trans. Amer. inst. min. eng.*, vols. vii. and ix.) led him to advocate the use of soft steel for rails. The late Professor Grüner agreed with this view. But many engineers remained unconvinced; since, they argued, the rails tested might have had other causes of weakness than an unsuitable amount of carbon.

In the course of the discussion of Mr. Snelus's paper, M. Cazes, chief of the permanent way of the *Chemin de fer du midi de France*, gave some interesting tables, showing that the hard rails used on that road lasted much longer than those on the Cologne-Minden railroad, which have a composition more nearly approaching Dr. Dudley's proposed formula. There is as yet no commonly accepted measure of the work done by a rail. It is usually measured either by the tonnage borne or by the number of trains which have passed over it; but in nearly all estimates the speed of the train, which is an important element in the measure, has been left out of the consideration.

In view of all these discordant results, the physical side of the question is coming into prominence. It is said that a sudden cooling or a powerful compression favors the passage of the carbon into 'hardening carbon;' and upon this chemical effect of a physical cause, M. L. Clemandot's new process of tempering steel by compression is based. It is evident that many more experiments are needed before any satisfactory theory can be adopted.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Microscopic rock-investigation. — In addition to the microscopic examination of thin rock-sections being made in the various divisions of the survey, especially in the Rocky-Mountain division at Denver, and by Mr. R. D. Irving and his assistants in the Lake-Superior region, arrangements have been perfected to carry on similar work at Washington, under the direction of Mr. J. S. Diller, who has recently been engaged in arranging the machinery and appliances for this work. The work of cutting and grinding rock-specimens has been carried on by Mr. Newman, under the immediate supervision of Mr. Diller. It is also intended, in this connection, to make the photographic division available; and preparatory measures, with this object in view, are being taken by Mr. Hillers, the photographer of the survey.

Rocks of Lassen's Peak. — Last July Mr. Diller, before undertaking the reconnoissance of the Cascade Range, made a six-days' trip from Red Bluff, California, to Lassen's Peak (or Butte), and collected a number of interesting rocks; and of these Mr. Newman made thin sections, the microscopic study of which occupied Mr. Diller's time during January. They included basalts, hypersthene andesites, hornblende andesites, dacites, and basaltic and andesitic tufas.

Lassen's Peak is composed of dacite. This rock Richthofen considered to be typical nevadite, but Mr. Diller's investigations confirm Mr. Iddings's view that it is dacite. Gray dacite is abundant about the southern base of the mountain, in smooth cliffs and ledges, and has a remarkably gneissic appearance. Red dacite forms the summit of the peak, and a large portion of the northern rim.

Basalt has, perhaps, the widest distribution of all the rocks found in the vicinity of Lassen's Peak, and it is, as a rule, the most recent of the flows. An older basalt has been found in the stratified tufa, which forms great belts along the western base of the mountain. Between Red Bluff and Mill-Creek valley, south of Lassen's Peak, a distance of forty-five miles, wherever the surface is not occupied by tufaceous deposits, the rocks are basaltic. Lassen's Peak is an ancient volcano, and has poured out a great variety of lavas which are arranged in a most favorable position for a study of their succession.

Rocks of Mount Shasta and vicinity. — During a part of February, Mr. Diller was busy with the microscopic study of the metamorphic and eruptive rocks collected by him last season, along the Sacramento River north of the mouth of Pit River, and on Mount Shasta. The metamorphic rocks referred to consist mainly of augitic gneisses; and the eruptive rocks of the same region are, in part, gabbros. Some of the latter present peculiarities that cannot be positively determined until some chemical examinations have been made. The specimens have therefore been submitted to Professor Clarke for chemical analysis.

Mr. Diller has examined some thirty thin sections of rocks from Mount Shasta, and finds that they are divisible into three groups; viz., hornblende andesite, hypersthene andesite, and basalt. The rocks of Shasta are quite similar to those of Lassen's Peak, with the exception that the basalts of the former are much richer in olivine, and contain less globulitic base.

Crater Mountain (or Shastina), on the north-west spur of Mount Shasta, is composed of hornblende andesite; and through this, on the western slope, there has burst a large stream of hypersthene andesite which stretches far to the westward, towards Sissen's ranch, in Strawberry valley, on the Sacramento.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Engineers' club, Philadelphia.

April 19. — Mr. S. N. Stewart described a cushioned pier and rolling trunnion drawbridge. With a working model, he showed that a six-pound draw could be turned by a pennyweight pressure or a breath, and claimed, that, with a leverage six times as great as that of the model, twenty pounds pressure would turn a hundred-ton draw. —— Mr. William P. Osler presented, for Mr. J. Godolphin Osborne, an account of the Pocahontas mine disaster. He showed how probable it was that gas would have been detected by the engineers had it existed, and explained the method of damming and flooding the mine with 17,500,000 gallons of water to extinguish it; the latter being accomplished in sixteen days, one day being lost in repair of a dam. The cause of the explosion is, as yet, unknown. —— Mr. E. S. Hutchinson supplemented the above by an account of his recent visit to the mine, confirming, as far as he had observed, Mr. Osborne's opinion of damage to the mine. Timbers were displaced, cars demolished, etc.; but there was no fall of roof, except in the fan-entry, where much slate had fallen, but where a week's work would repair damage. He attributed the safety of the roof to the fact that from 12″ to 18″ of coal had been left as an elastic support to the treacherous slate above. He considered the presence of five or six inches of fine, dry coal-dust on the floor a phenomenon of special interest, and, while withholding a positive opinion in view of pending investigations by a committee of the American society of mining-engineers, he referred to a number of authorities to show the important bearing dust-explosions have upon safety in mines, like this, apparently entirely free from fire-damp. —— Mr. J. Foster Crowell announced that the new bridge of the Pennsylvania Schuylkill valley railroad, over the Schuylkill River at Manayunk, had just been completed, and noted, as a remarkable illustration of the vast strides made in American bridge-construction during the past few years, that so large and important structure as this is, being one-third of a mile in length and ninety feet high, can be reared and come into use without exciting special interest, or even deserving particular mention from an engineering point of view. —— The secretary read, from Mr. J. H. Murphy, a discussion of the switch formulae by Mr. John Marston. —— Mr. A. R. Roberts described a contrivance he had designed, by which a three-throw point switch can be operated from a single stand.

Linnaean society, New York.

April 18. — Mr. E. P. Bicknell read the third instalment of his paper, 'A study of the singing of our birds,' treating the Passeres to Astragalinus tristis in the same vein as the already published portions of this elaborate treatise. —— Mr. R. F. Pearsall called the attention of the society to the similarity of some of the notes of Parus atricapillus to those of Contopus virens, which accounted for the erroneous winter records of unseen individuals of the latter species. —— Mr. E. P. Bicknell related his spring observations for 1884 at Riverdale, N.Y., upon the first appearance of birds, flowers, etc. —— A communication from Judge Bicknell of New Albany, Ind., stated that the English sparrow flew from that city to the ripening grain-fields, and hence the reduction, by one-half, of the promised crop. Only a very slight indulgence in

tivorous diet by this bird was noted by this ...orous writer. —— Dr. C. S. Allen mentioned the exhibition of a carnivorous propensity in the common barnyard duck, which he had seen catch P. domesticus, hurry with the struggling bird to the duck-pond, drown and immediately devour the victim, usually swallowing it whole. —— Dr. Allen placed on record the finding, June 15, 1881, upon the Island of Grand Menan, by himself and the late Dr. Edward Southworth, of the nest with four eggs of Empidonax flaviventris, the yellow-bellied fly-catcher, built in the moss upon the north side of an inclination, partly covered over by moss, grass, and twigs. It was lined with the fine tops of grasses, cow's hair, and fine rootlets, and located in a soft, swampy spot, where there were few large trees. The male bird was not seen; but the female was almost caught by the hand, so closely did she sit.

Boston society of natural history.

April 16. — In a paper on the relation of the 'Keweenawan series' to the 'eastern sandstone' in the vicinity of Torch Lake, Michigan, it was pointed out by M. E. Wadsworth that the Keweenawan series was first established by observations made at Douglass Houghton Falls, near Torch Lake. These observations were supposed to show that the eastern sandstone lay horizontally up to the falls, and contained the *débris* of the supposed old seashore cliff over which the stream now fell. In 1880, Wadsworth showed that the eastern sandstone, instead of being horizontal, gradually dipped, as the falls were approached, to the north-west, the dip increasing from five degrees up to twenty-five degrees at the falls. He then pointed out that this sandstone contained old basaltic lava-flows intercalated with it, which explained the origin of the basaltic *débris* previously found here, and showed that the Keweenawan series and eastern sandstone were the same formation. In the third annual report of the director of the U. S. geological survey, the correctness of these observations have been admitted, with the statement that at some distance below the falls the rocks were found to be covered, and that Wadsworth bridged in his imagination the gap between the sandstones dipping five degrees and those above having a steeper dip. The lower ones are said to be the true eastern sandstone, and those nearer the falls to belong to the Keweenawan series, while they were separated by a hypothetical seashore cliff inserted in the covered space. To this Wadsworth replied, that, by digging in the stream and on the banks of the ravine, he had actually traced (not imagined) the relations of these rocks, going from those dipping five degrees up to those dipping twenty-five degrees, and that they were seen to form a continuous superimposed series, no such cliff as imagined existing between them. Wadsworth had also shown, in 1880, that the eastern sandstone was exposed on the Hungarian River up to its junction with the Keweenawan series. On this stream the sandstone had a varying dip from ten to twenty degrees to the north-west; and, although sometimes dipping in all directions, the prevailing one was north-west. At the junction, the sandstone was baked and indurated by the first basaltic lava-flow of the Keweenawan series, which in its turn had been denuded, and its *débris* built into a conglomerate, forming the fifth fall of the river. In the above-mentioned report, doubt was thrown on these observations by the statement that the observed sandstone was a loose piece, or, if not, the basaltic rock surely was, and that the prevailing dip of the sandstone was to the south-east. Wadsworth replied, that the dips given in the report appeared to have been taken from the frost-dislocated rock on the sides of the stream, while his were taken in the bed of the stream, when the water was exceptionally low. He further stated that the sandstone at the junction was continuous with that seen below; that it extended across the stream and into the banks on both sides; while the baking and induration of it showed that it must have been overflowed by some heated rock. Again: the basaltic rock extended across the stream into both banks, and was found to underlie the conglomerate, and that he dug the *débris* of the former out of the overlying base of the latter. All this, he said, showed conclusively that these rocks were *in situ*, and proved that here the eastern sandstone and Keweenawan series were one and the same; also that this series could not be maintained, as first established. He further pointed out that the claim advanced by many geologists, that the eastern sandstone did not contain the *débris* of the porphyry conglomerates of the Keweenawan series, was entirely opposed to the views of the same observers, that the eastern sandstone was younger than that series, and made out of its *débris*.

Appalachian mountain club, Boston.

April 9. — A paper by Prof. W. W. Bailey, on the west Humboldt Mountains, Nevada, gave some experiences of the author while attached to the U. S. geological survey. He explored Wright's cañon, and noticed the extraordinary effect of diurnal evaporation, the streams entirely disappearing during the heat of the day. The flora of the Buena Vista and Coyote cañons, on the eastern side of the Sierra Nevada, was found to be very distinct from that of the western side of the range. —— Rev. Luther Farnham gave accounts of three visits to the White Mountains, in 1837, 1862, and 1883. —— Mr. R. B. Lawrence gave accounts of the explorations of the southern Alps of New Zealand by Messrs. Green, Haast, and Van Lendenfeld.

Academy of natural sciences, Philadelphia.

March 22. — Prof. Edward D. Cope presented the results of his study of material illustrating the various forms of mastodon. He believed he could distinguish nine species from American formations, while those of other countries would probably bring the number up to eighteen or twenty. There are probably two genera. The oldest American mastodon comes from the upper half of the miocene, an assertion that one had been found lower down being undoubtedly incorrect. The division of the genera into two groups, founded upon dental characters, was sug-

gested, — one, represented by the Mastodon ohioticus, being characterized by the absence of inferior incisors; and the other, to which might be referred the genus Tetracaulodon, having these teeth.

March 27. — Dr. Joseph Leidy called attention to a specimen of a lizard, apparently Eumeces chalcides, which is remarkable for the small size of its limbs. They are, indeed, so small as to be almost invisible, thus giving the creature the appearance of a little snake; yet each limb has five well-developed toes. The specimen was from Petchaburi, Siam, where the natives regard it as a snake, and, as is common in such cases, consider it venomous.

April 1. — Dr. Joseph Leidy called attention to a mass composed of the tubes of Serpula dianthus from Barnegat Bay. The accumulation of the material is so great as to almost form a reef extending out from the bay. The locality is a famous one for sheep's-head-fishing, the fishes probably finding their food-supply in the worms. It was suggested that other marine animals may congregate there for the same reason, so that the locality is probably one specially worthy of the attention of zoölogical students. —— Referring to some observations of Kerner respecting the thawing-out of chambers in ice by living plants in the Alps of Europe, Mr. T. Meehan confirmed them by some observations made during the last winter on Eranthis hyemalis. At the end of January the plant was in flower after a few warm days, when a driving snow-storm prostrated the little stems, and covered them nearly a foot deep, in which condition they remained till early in March. After they had been three weeks in this condition, the snow was carefully removed, when it was found that the stems had become perfectly erect, a little chamber in the snow having been thawed out about each flower-stem. There was, however, no other evidence of growth. The few buds which were unopened when the snow came, were still unopened when the snow thawed away, after five weeks imprisonment; and the idea conveyed was, that plants would retain life without growth for an indefinite time, when under a low temperature, such as a covering of ice or snow afforded.

April 15. — Dr. Charles S. Dolley of Johns Hopkins university spoke of a form of so-called parenchymatous or interstitial digestion described by Korotneff as occurring in Salpa and Anchinia. It had been asserted that a large amoeboid cell existing in the intestines of these animals takes up the nutritive particles and passes them on into the tissues, and that in other related forms a plasmodium performs the same function. Dr. Dolley had observed the appearance in the intestines of Salpa, which had been described by the Russian author, but he would suggest an entirely different interpretation thereof. In Salpa we find a large branchial sac, representing the true pharynx, at the posterior portion of which is the stomach. The endostyle, or thickened bottom of a fold or groove of the branchial sac, throws out a supply of mucus, which covers the surface like a curtain, and in which nutritive particles finding their way into the animal are embedded. The food is carried back by cilia, and the mucous sheet is wound up into a thread, which can be traced into the oeso gus, and from there to the stomach. In Dr. Dolley's opinion, this mucous exudation is the amoeboid cell described by other observers, it having been found laden with nutriment in some three thousand sections of Salpa. When food is not present, the appearance indicated cannot be observed. —— Dr. N. A. Randolph described a test for the presence of small quantities of peptone in solution. If the acid nitrate of mercury (Millon's reagent) be added to a cold aqueous solution of potassium iodide, a red precipitate of mercuric iodide always appears. When, however, either peptone or the biliary salts are present in noteworthy amount, the precipitate of nascent mercuric iodide assumes the yellow phase. In order to render the test sensitive to the presence of minute quantities of the substances in question, he had found it necessary to limit the amount of potassium iodide employed. Thus, to each five cubic centimetres of suspected fluid, which must be cold and either neutral or faintly acid, are added two drops of a saturated solution of potassium iodide, the two liquids being well mixed. Four or five drops of Millon's reagent are now added, and the contents of the vessel well stirred or shaken. Under these circumstances, the presence of peptone in amounts of less than one part in five thousand is readily shown. By the exercise of great care in the performance of the test, he had been able to demonstrate the presence of peptone in a solution containing but one part of that body in seventeen thousand parts of water. The conditions interfering with this reaction are, alkalinity of the fluid examined; heat, which has the same influence upon the nascent mercuric iodide as have peptone and the biliary salts; and the presence of certain compounds, as potassium ferro-cyanide, which prevent the production of the mercuric iodide. The reaction described presents certain advantages from the fact that it is uninfluenced by the bodies usually found in the various organic fluids, although useless as an isolated test, inasmuch as it responds to two entirely different compounds, peptone and the biliary salts. —— Mr. Meehan referred to his former communications on the subject of the relation of heat to the sexes of flowers. He exhibited catkins and flowers of the European hazel (Corylus avellana) just matured, and which, for the first time in several years past, had perfected themselves contemporaneously. The past winter had been distinguished by a uniform low temperature the entire season. In other years a few warm days in winter would advance the male flowers so that they would mature weeks before the female flowers opened: hence the females were generally unfertilized, and there were few or no nuts. Under this law, it was evident, amentaceous plants could not abound to any great extent in countries or in localities favorable to bringing forward the male flowers before there was steady warmth enough to advance the female. He thought this was likely to be the reason why so many coniferous trees under culture in the vicinity of Philadelphia bore scarcely any fertile seed in their cones, — a fact which had often been remarked in connection especially with

the Norway spruce. The male flowers would mature before the female had advanced far enough to be receptive of the pollen. —— Mr. Meehan also stated that in his garden at Germantown, there were few trees that did not exude sap from wounds made in winter or early spring; but among them all, few bled, as it was termed by horticulturists, more profusely than Cladastris tinctoria. The icicles formed from this exuding sap afforded a good opportunity to frost the saccharine character of the liquid. During congelation by frost, all foreign substances were rejected, and, in the formation of the icicle, the sugar was pushed forward to the extreme point. The end of an icicle of a sugar-maple was its only sweet part, and this was very sweet from the accumulation of the saccharine matter. The end of the icicle from the Cladastris was also sweet, though less so than in any other sugar-bearing tree he had observed.

Philosophical society, Washington.

March 1. — Gen. R. D. Mussey read a paper on the application of physical methods to intellectual science, discussing the extent to which those methods which have been successfully employed in the investigation of the phenomena of nature are applicable to the sciences whose subject-matter is mental operations. —— Mr. I. C. Russell followed with a communication on deposits of volcanic dust in the Great Basin. The sediments of the great quaternary lake of western Nevada, named Lahontan by Mr. Clarence King, include as minor members certain strata of white, unconsolidated, dust-like material closely resembling diatomaceous earth. Microscopic examination shows them to consist of minute shards of glass, and indicates their volcanic origin. Similar strata occur in the deposits of the quaternary lake which occupied the Mono basin, adjacent to the Lahontan; but these are coarser, and include fragments with pumiceous structure. Fragments of pumice are likewise found on the surface of the land in the vicinity of Mono Lake, and the distribution of these indicates their origin in a chain of rhyolitic cones extending southward from Mono Lake. The subaerial deposits belong to eruptions which, though prehistoric, must be quite recent. The sub-aqueous deposits were derived from quaternary eruptions. Those of the Mono basin can be referred, without hesitation, to the Mono craters; and those of the Lahontan basin are provisionally referred to the same source. Up to the present time, no other rhyolitic volcanoes of quaternary age have been discovered in the vicinity. Dr. T. Antisell remarked that the source of the volcanic dust should not be sought in existing volcanoes on the land: he regarded pumice as the product of submarine eruption exclusively. —— Mr. L. F. Ward read a paper on some physical and economic features of the upper Missouri system, describing the ancient and modern flood-plains of the Missouri and the Yellowstone where they issue from the mountains, and discussing the method of their formation. These are susceptible of irrigation; but diversion of river-water for that purpose, and its distribution over the land, involve difficult problems in political economy. The matter is a proper subject for governmental control. Discussion followed, in the course of which Prof. C. V. Riley remarked that the final solution of the grasshopper problem lies in the cultivation of the northern plains.

March 15. — Mr. G. K. Gilbert spoke on the diversion of water-courses by the rotation of the earth, maintaining, that, under certain indicated conditions, the deflecting force generally admitted to result from terrestrial rotation should result in observable modifications of valley configuration. —— Mr. G. E. Curtis read a paper on the relations between northers and magnetic disturbances at Havana, discussing the coincidences which had been pointed out, and demonstrating their accidental nature.

NOTES AND NEWS.

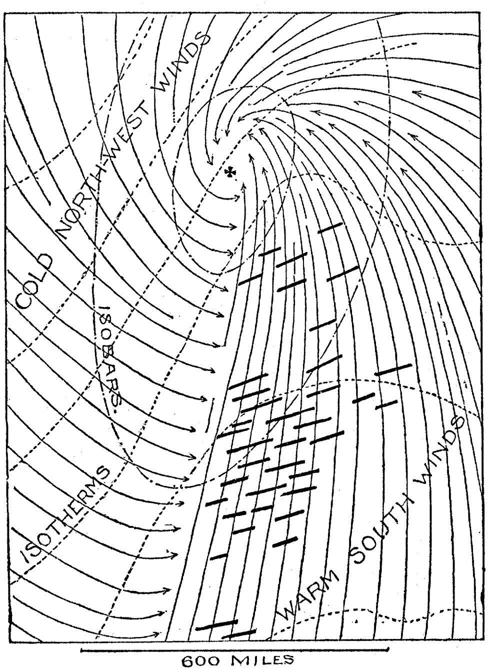
BY invitation of the authorities of the Johns Hopkins university, Sir William Thomson will deliver, in October next, a course of eighteen lectures on molecular dynamics, before the physical section of the Johns Hopkins university, beginning on Wednesday, Oct. 1. These lectures are intended only for students who are interested in advanced work. Professors and students of physics are invited to attend; and arrangements will be made by which they may easily obtain temporary lodgings, provided an early intimation is received of their intention to come. A registration fee of five dollars will be required.

— The Montreal local executive committee of the British association for the advancement of science is prepared to enroll ladies and gentlemen, residents on the continent of America, as members of the association, on the following conditions: 1°. Life members for a single payment of fifty dollars; 2°. Annual members for a payment of ten dollars the first year, and five dollars each consecutive year thereafter; 3°. Associate members for a payment of five dollars. Associates are not eligible to hold office in, nor to serve on any committees of, the association; nor do they receive the annual reports. All other privileges of membership for the year are open to them. No person who is not a member is admitted to any of the meetings of the association. The privilege of reduced fares by the railway and steamboat lines is limited to the life, annual, and associate members. Applications for admission to membership may be addressed to Mr. J. D. Crawford, post-office box 147, Montreal.

— Bliss's classified index to the maps in Petermann's *Geographische mittheilungen*, from 1855 to 1881, has just been issued by Harvard college library in advance of its completion, in the *Bulletin* of the university. It occupies fifty-five small quarto pages, and will be found exceedingly helpful to those using that treasury of excellent charts. The principal division is, of course, geographical; but many titles are conveniently repeated under the miscellaneous head,

including mainly meteorological, seismological, geological, botanical, and zoölogical maps. A reference-list to persons, expeditions, and surveys, is also appended.

— The third series of charts published by the signal-service, to illustrate the studies of tornadoes undertaken this year, represents the storms of March 25. Twenty tornado-tracks are mapped, scattered over the states south and east of Indiana. Their times are all in the afternoon or evening, and their courses, as usual, bear about east-north-east. The results of these disasters are at present counted thus: number of persons killed, 77; wounded, 298; valuation of property destroyed, $950,000. The contrast of the small, local tornado-whirls and the great sweep of the cyclonic circulation is clearly marked; and the attitude of the tornadoes, relative to the cyclone centre



and the warm and cold winds, is seen to be about the same as was shown on the earlier charts for Feb. 19 and March 11. The accompanying diagram is designed to show this relation in a general way, being based on an average of the three sets of charts. The nearly north-and-south elongation of the barometric depression is a departure from the more easterly trend of the major axis of the isobaric curves given in Loomis's averages; and this peculiar form is doubtless to be held in chief part accountable for the significantly abrupt change from the cold north-westerly winds of the western half of the cyclonic area to the warm southerly winds of the eastern half. The contrast of temperature thus produced is exhibited in the oblique trend and close approach of the isothermal lines, which are drawn for ten-degree differences. But most striking is the limitation of the tornado to that part of the warm southerly winds which is immediately overflowed by the cold winds, and the advance of the tornadoes, not with the surface-currents, but parallel to the spiral course of the cold blast overhead, through which the warm lower air ascends. The limitation of tornadoes to certain parts of cyclones, as thus shown, is a most hopeful sign, that, with longer and more detailed study, the smaller storms may, a few years hence, be predicted with a much accuracy as the larger ones are now.

— Prof. George F. Wright has contributed a good article on 'the Niagara gorge as a chronometer' to the April number of the *Bibliotheca sacra*. The conclusion is reached that the entire gorge from Queenstown to the Falls is the result of post-glacial cutting and that the most probable rate of recession of the falls is about three feet a year; thus placing the end of the glacial period here about twelve thousand years ago. This agrees very well with the date determined by Prof. N. H. Winchell from the Falls of St. Anthony. The inconvenience to naturalists of having such an article as this stowed away in a theological magazine may be counterbalanced by the satisfaction they should feel on learning that it could be accepted there at all.

— Arrangements have been completed for holding at the university library, Berkeley, Cal., during the last week of May, a loan exhibition of books illustrative of the history and progress of printing.

— The government of Newfoundland has voted to establish a geological museum at St. Johns. Mr. James P. Howley, the geological surveyor, is now giving his whole time to it, and, before the year is over, the museum will be open to the public and to students. The collections made by Alexander Murray and James P. Howley are especially rich in orthoceratites, trilobites, and fossils of the primordial fauna.

— A cable message received at Harvard college observatory announces the discovery of an asteroid (No. 236) by Palisa, at Vienna. Its position was, April 26, 40.42 Greenwich mean time; right ascension, 13h., 0m., 43.5s.; declination south, 3° 21′ 41″; daily motion in right ascension, 44s.; in denomination, N. 6°. It is of the twelfth magnitude.

— The *Engineer* of March 29 gives a new method of preparing wood-blocks for paving, practised by Mr. Mallet of Moissac. He boils them in a solution of sulphate of copper, sulphate of zinc, and chloride of sodium, mixed with heavy mineral oil, linseed-oil, and tallow, and afterwards compresses them to about one-tenth of their original volume.

— In our last number, p. 503, Dr. Sturtevant's quotation from the *American journal of science*, which he attributes to Professor Asa Gray, is from a reprint of a portion of Dr. Carpenter's article in the *Philosophical transactions*. As Professor Gray's name does not appear in any connection, even in the introduction, and as the whole extract from Dr. Carpenter is within quotation-marks, the mistake seems unaccountable.